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William Cline Borden, M. D., F. R. M. S.

CAPTAIN, MEDICAL DEPARTMENT, U. S. ARMY.

WITH FRONTISPIECE.

Dr. Borden was born in Watertown, N. Y., May 19, 1858. His ancestry is American since 1635 when Richard Borden, known in the family annals as "The Emigrant" emigrated from Borden, Kent County, England, and settled at what is now Portsmouth, Rhode Island. From there his direct ancestors moved to New Jersey, where the family name is perpetuated in the town of Bordentown, and thence to New York.

His early education was in the public schools, later he entered the Hungerford Collegiate Institute at Adams, N. Y., and there pursued an elective, academic and scientific course.

In 1879, he began the study of medicine and March 15, 1883, he received the degree of M. D., graduating from the Medical Department of the Columbian University, Washington, D. C. A few months later he passed the examination required for admission to the Medical Department of the United States Army and December 3, 1883, he was given a commission as Assistant Surgeon with the rank of First Lieutenant. His first service was in the Department of the Platte at Fort Bridger, Wyoming, then at Fort Douglas, Salt Lake City, Utah. In 1888 he was transferred to the Department of Texas and promoted to the rank of Captain. He remained in Texas until 1891, serving at San Antonio, Fort Ringgold and Fort Davis, when he was ordered to Jackson Barracks, New Orleans, Louisiana. While on duty there he was sent

in 1892 for temporary duty with the community of Apache Indians held as prisoners at Mount Vernon Burracks, Alabama, and for his sanitary work with these Indians he was commended in the Annual Report of the Surgeon General of the Army for that year. Owing to the high death rate of these Indians from tuberculosis, he became interested in their vital statistics and published a paper in the Boston Medical and Surgical Journal entitled "The Vital Statistics of an Apache Indian Community" in which their statistics for five years were compiled, and which is of interest as probably being the only accurate vital statistics of an indian community ever published.

From New Orleans, Dr. Borden was transferred to Fort Adams, Newport, Rhode Island, and from there to his present station, Fort Snelling, near St. Paul, Minnesota.

Dr. Borden first began work in Microscopy when attending his first course of medical lectures. At that time a three years graded course of study and practical work in histology and pathology were required but in few of the medical colleges of the United States of which the Columbian University was one, and as he became interested in microscopical work, the graded course gave him more time to follow his studies in that line than was available to the average medical student. After entering the Medical Department of the Army he continued his microscopical work and soon began work in photomicrography.

He is the author of a number of monographs on subjects connected with general and military medicine, histology, microscopical technique, photomicrography, and photography, and he is a member of the Associations of Military Surgeons of the United States, and a Fellow of the Royal Microscopical Society of England.

A Simple Means of Comparing the Apertures of Objectives.

BY R. B. L. RAWLINGS,

NASHVILLE, TENN.

While the subject of aperture is of interest to every worker who prizes his objectives and wishes to understand their exact capacity, the high price of the Abbé Apertometer leaves the great majority of microscopists without a means of determining aperture.

From numerous tables which have been published comparing the actual aperture of lenses with what is claimed for them, it is seen that in many instances the performance of the objective cannot be what is claimed for it.

A search amongst the catalogues at hand of several of the leading opticians of the world fails to show an apertometer of any description listed in any of them, with the single exception of the Abbé, listed by Zeiss.

While the idea of the arrangement in the experiment below detailed is suggested from a study of the Abbé form of apertometer, it is essentially different in half the technique.

For the benefit of those who are not familiar with the instrument and in the hope that I may make the proposed modification plainer, it may not be amiss to attempt a short explanation of its working, particularly as this is not done in the Zeiss catalogue.

It consists essentially of (a) an auxiliary objective and (b) the plate glass semicircular and prismatic disc.

The objective has a focal distance of about 3 inches, is mounted with a society screw and has screwed in the upper part of the mounting a cylinder with a small diaphram in its upper end.

This objective is to be screwed into the lower end of the draw tube after the objective to be examined has been focussed on the disc, care being used not to disturb the focal arrangement of the objective in the nose piece. Its purpose is for the reading of the indices. The draw tube

thus equipped is the auxiliary microscope.

The disc (b) is of plate glass and is placed on the stage of the microscope. It is semicircular, with the semicircular margin vertical and polished, as are all its surfaces; the back edge is ground at an angle of 45°, base of the prism upwards.

The upper surface has two sets of graduations on it, the outer circle being for numerical and the inner for angular aperture. Corresponding to the centre of the circle is the small perforated silvered disc, mounted under a cover glass, and through which the *image* of the indices is observed. Over the right-angled margin of the semicircle, slide two L shaped indices so made as to hang on the upper edge of the disc and lie against the vertical margin. The light horizontally striking the vertical edge of the plate glass disc projects the images of the indices on the margin in such a manner that they appear to lie horizontally along the diameter of the semicircle directly under or to the right and left of the objective according as they are moved.

The indices are brought near the centre of the margin of the semicircle, and by sliding the draw tube up or down within the body tube (care being taken not to alter the focus of the objective to be measured which has been focussed on the centre of the silvered perforated disc previous to attachment of auxiliary objective to draw tube) a sharp image is obtained of the indices. They are then moved around one on each side, until their points are barely visible within the circle of light. The reading is then made direct from their inner edges in numerical or angular aperture as desired.

For the experiment herein detailed, a substage condenser and iris diaphram are necessary accessories, although one may proceed in a crude and unsatisfactory way without the latter.

The objectives whose apertures are to be compared, are

to be examined, beginning with the lowest angled ones and proceeding upwards.

With the tube length corresponding to the correction of the objective if it is non-adjustable, focus the objective to be examined on the upper surface of the condenser. Pressing the body tube against the rack to prevent alteration of the focus, unscrew draw tube adapter and remove draw tube. Into the lower end of the draw tube screw a 3-inch objective. Replace draw tube in proper position. This forms the auxiliary, observation or draw tube microscope, and is for observing an image at its focal distance through the objective under observation as a medium admitting divergent rays of light, and not as an objective.

Reduce the aperture in iris diaphram of substage to lowest size. Pressing body tube against rack as before to prevent alteration of focus, focus the draw tube by sliding it in the main tube sharply on opening in iris diaphram. Then open diaphram until only a glimpse of its margin can be seen. The diameter of the opening thus obtained is in direct ratio to the angular aperture of the objective. Leaving the diaphragm as it is, repeat the experiment using the next higher objective at hand, remembering in every instance to remove the draw tube objective and focus the one to be examined on the top surface of condenser. In the second instance, after the draw tube microscope has been focussed on the diaphram, a margin will remain. Increase opening as before until only a line of the margin of diaphragm is visible.

The experiment may be repeated on higher powers until the angle of aperture of the condenser system is reached or approximated.

While any great alteration in the focal distance of objective under observation will cause an appreciable error in the comparison, a considerable range is allowable without perceptible difference. Thus the experiment may be much simplified and yet retain its accuracy by making

one insertion of the objective in the draw tube answer for
the examination of all the objectives, without its having
to be removed for each time. The auxiliary objective is
put in position, the one to be examined is put in the nose
piece and its focal distance approximated, which can
usually be done pretty nearly by one familiar with the
objective.

While in these experiments no real figures can be got-
ten at, it is easily within the power of the maker to
supply them with high class instruments at a very
moderate price. All the other tests of an objective are
within easy reach of the worker, why should not this
supreme test of its workmanship also be within his reach?

The principle that the maker can take advantage of is
this. The position of the knob which regulates the supply
of light through the diaphragm is of course directly re-
lative to the size of the opening.

Fitted over the outer collar of the diaphragm may be
attached a plate extending forward two inches, being
rounded to an arc of 80°—90°, with a radius which would
be about 3 inches. In place of the knob used to regulate
the opening, an index pointer is screwed in place. The
arc is so graduated as to indicate the aperture of the ob-
jective when the iris diaphragm has been viewed and ar-
ranged as above stated.

While for the ordinary worker the problem of gradu-
ating this arc might be very difficult, owing to the fact
that very accurate measurements must be made of the
diaphragm opening, the refraction of light through two
kinds of glass with a spherical triangle of air interposing,
the radius of the part of the condenser used, to be deter-
mined, etc., to the practical optician such calculations are
easy enough.

White's Objects.—The Central Board of Education,
Fifth Avenue High School Building, Pittsburg, Pa., has
just purchased 80 White Objects for use of the depart-
ment of biology, Ed. Rynearson, teacher,

The Value of Peroxide of Hydrogen in the Preparation of Entire Insects.

By CHARLES E. HANAMAN,
TROY, N. Y.

The use of peroxide of hydrogen in microscopical technic has, in so far as I am aware, been limited to the bleaching of sections which have been blackened by osmic acid or stained green by chromic acid hardening agents and for the rapid ripening (by oxidation) of haematoxylin staining fluids.

The usual method of preparing entire insects has been to remove by the use of caustic soda or potash all of the soft parts, the resulting preparation consisting only of the exoskeleton. Such preparations are useful for the study of the sclerites, but it has often seemed to me desirable to make preparations which would show the relation of the muscles and the viscera to the sclerites, while all the parts remained *in situ*. Such specimens would be especially useful for comparison with sections and dissections of other specimens of the same insect.

The dark, and often times opaque, color of the chitin composing the exoskeleton has heretofore prevented the successful making of preparations of this kind from the majority of insects.

Searching for some method by which the opaque chitin might be rendered transparent without injury to the contained soft parts, I happened to think of peroxide of hydrogen and I believe I have found in it the reagent I was seeking for.

To illustrate its use, and perhaps at the same time to aid some beginner to make preparations suitable for the study of insect anatomy, I have detailed below the preparation of a common house-fly; it being the insect upon which the discovery of the usefulness, in this connection, of the peroxide was made.

Permit me to state here, that my microscopial studies are subject to frequent and sometimes to long continued interruptions from business causes, and that nearly all of

my work is done in the evening, so that the intervals between the operations, described below, are often due to
such interruptions rather than to their being necessarily
required by the process. I do not think, however, that
anything would be gained, in the present instance, by
shortening any of the intervals given below.

The fly was placed under a bell-glass, together with a
piece of blotting paper which had been saturated with
chloroform, and the moment the insect ceased to move,
it was dropped into a small beaker of boiling water, the
lamp by which the water was heated, being withdrawn
the moment the insect entered the water: this was done
for the purpose of killing and fixing the soft tissues, heat
being the only successful reagent for this purpose, excepting in cases where the chitinous integument can be
slit up so as to allow the entrance of a liquid fixing
agent, no fixing agent excepting heat being known which
will penetrate through chitin with sufficient rapidity to
fix the enclosed protoplasm before post-mortem changes
have begun. The moment the fly, which was a female,
entered the water the proboscis and the ovipositor were
fully protruded and extended, and remained so during
the succeeding manipulations.

The insect was left in the hot water for about five
minutes and was thoroughly washed in it. It was then
placed upon a small piece of glass (about one half of a
mounting slip) and the legs, wings, etc., were arranged
so as to afford the best display, another piece of glass of
the same size and shape as the first was placed over it,
but prevented from pressing upon the specimen, more
than just enough to hold it in place, by bits of glass, of
the proper thickness, being inserted between the ends of
the two plates; the whole was then bound together by
means of thread wound around them and dropped into a
jar of 30 p. c. alcohol which was changed, with intervals
of twenty-four hours between each change, to 40 p.c.—
50 p.c.—70 p.c.—80 p.c. and 95 p.c. strength.

After a stay of several days in the alcohol the thread was taken off and the fly washed in fresh alcohol, from which it was transferred to a slender dish containing 18 parts of 95 p.c. alcohol and 2 parts of peroxide of hydrogen, from a freshly opened bottle of Marchand's solution.

At the end of 24 hours, immersion in the solution the abdomen of the insect had whitened somewhat; after another 24 hours the thorax and the head had bleached perceptibly and the eyes were seen to be losing their red pigment. The specimen was now left for 48 hours longer, and at the end of this time, 96 hours from its first immersion in the peroxide solution, the whole insect was as white as chalk.

The specimen was then rapidly washed in strong alcohol and placed for complete dehydration and staining at the same time, in 95 p.c. alcohol to which had been added 1-20 p.c. of eosin, this staining agent being the one recommended by most authorities for staining through chitin on account of its great power of penetration. After remaining for 24 hours in the alcohol-eosin bath it was rinsed in fresh alcohol and placed in xylol to clear. In an hour's time the whole structure had cleared perfectly and the specimen was mounted in xylol-balsam in a zylonite cell, and presented a most beautiful and interesting appearance under the microscope.

The chitin had been rendered almost as transparent as glass, the eosin had given it a faint rosy tint while the spine like hairs were more darkly stained; through the transparent but very evident exoskeleton were to be seen the muscles and their attachments and much of the viscera; the abdomen was seen to be filled with eggs, arranged in two rows along each side of the median line of the dorsum, the embroyos within the eggs were clearly visible, the chitinous egg-shells having been rendered very transparent, permitting much of the detail of the protoplasmic structures within to be seen.

Studies in the Elements of the Anatomy of the Lower Vertebrates.

By HENRY LESLIE OSBORN,
HAMLINE UNIVERSITY, ST. PAUL, MINN.

PART II.

THE TAILED AMPHIBIAN.

Amblystoma tigrinum, The Salamander.

CONTENTS.

[This discription is drawn directly from Amblystoma tigrinum, a species that is abundant in the outskirts of Saint Paul, especially in the Autumn months during damp weather. It will apply to any of the urodeles well enough for the purposes of a guide; and can be used for the frog, though with considerable modifications, especially for the skeleton of the body.]

1. EXTERNAL ANATOMY.—The characteristic external features as found in the higher vertebrates are readily seen, viz: a division of the body into *head*, *neck*, *trunk* and *post-abdomen*; the presence of an *anterior* and a *posterior* limb. Examine these and note in each three principal regions: *upper*, *middle* and *lower* which are similar in all but not precisely the same. Of the front limb the upper region is called the *brachium*, the middle the *ante-brachium*, and the lower the *manus* which is again divided into: the *carpus* or *wrist* and the *digits*. The hind limb in a similar manner presents: the *thigh*, the *crus* and the *pes*, which is divided into the *tarsus*, and *digits*. How do these regions compare as to length? What differences do you find between the manus and the pes? How do the limbs compare with those of the frog? Do you recognize the

same regions in the limbs of all the vertebrates? Note that the *shape of the body* is that of a fish as to the post-abdomen which is compressed and used in swimming when the animal is in the water, while anteriorly the head and to a less degree the trunk are flattened from above downward, in relation to terrestrial life. Study the *distribution of color* noting the general naked skin black in color, with yellow spots; note that in some cases the patterns of the right and left sides seem to abruptly stop in the middle dorsal line. In the larger specimens there are no traces of median fins but in younger specimens even though they have attained considerable size and are living on land there are sometimes decided indications of the dorsal fin; and in occasional large specimens there are decided vestiges of gills. If it is possible you should observe the locomotion of the animal: on land by running on the legs with extreme bendings of the body in the same lines as in swimming: in the water commonly by walking but when excited by swimming, in which case the limbs are entirely unused. Compare the external form with that of other vertebrates, as you did in studying the fish.

2. THE HEAD is divisible into a *cranium*, which hardly appears externally; and the *face*, which both in front and on the side and below composes the bulk of the head. Note the rounded front and broad flat hinder part of the head and the very large *gape* of the mouth which literally opens from ear to ear. Observe and locate the two nostrils *anterior nares*; cut away the skin behind one and find the *nose chamber;* explore its boundaries, note its smooth mucous lining, *olfactory mucous membrane;* and in the outer and hinder angle note the *posterior nares;* pass a bristle through this and note that it emerges in the mouth chamber. Examine the eyes, as to location, size and shape. Do you find *lids*? Cut away the surround-

ing tissues and display the *eye-ball*; recognize the various parts and compare them with those of the smelt. Cut away the skin and muscle from the dorsal hinder surface of the head. You will thus be able to find the bony *brain-case* in the middle and hinder part, and on either side behind a lateral bony extension lodging the *ear-capsule*. From this the bones of the upper jaw run forward to meet in the middle line in front.

The lower jaw articulates with the upper near the ears. The *ear* does not show externally in the salamander but it does in the frog in the form of a rounded piece the *tympanum*. Cut into the ear capsule and you will find some of the parts of the ear, for a detailed description of which a more extended work must be consulted. Open the mouth widely and examine its interior. Are there any teeth? If so where and of what form and number? Note the large and fleshy *tongue*, what is its shape and mode of attachment? The narrow slit back of the tongue is the *glottis* it leads into the wind pipe. Note at the back of the mouth chamber the opening of the *gullet*; as in the fish there is *no distinct throat*. The hinder part of the mouth chamber is the equivalent of the throat; and in younger specimens its walls are perforated and allow water to pass out over gills which at that time are present and used for respiration as in the fish. (In some urodeles the gills and fins persist through life e. g., *Necturus*).

3. THE BRAIN.—Cut away the cranial bones dorsally, noting that they form a thin layer covering a capsule of cartilage which immediately encloses the brain. In removing the bones to display the brain be very careful not to injure the latter. The situation of the brain should be first noted in the hinder part of the head; its relation to the sense organs should be ascertained and the facts recorded. Study the different principal parts

of the brain comparing them with the fish as you progress. The *medulla oblongata* is most posterior and is seen to be a continuation of the tissue of the spinal cord. On its dorsal side there is a considerable open space. Crossing which and in front of it is a narrow *cerebellum*. Directly in front of these is a rounded mass (apparently single but really paired) the *optic lobes*; and in front of these again are two elongate masses the two *cerebral hemispheres*. They are attached behind through the crura cerebri which run under the optic lobes to the medulla; there is no transverse nervous connection between the two hemispheres (*corpus callosum* of the higher vertebrates). In recognizing these parts you will probably see some of the cranial nerves running from the brain chiefly from the medulla to various parts of the head.

4. THE BODY CAVITY.—Locate the wall of the body cavity. It is limited posteriorly by the cloaca, behind the level of the hind legs. Note the regular cross foldings in the side wall of the body; they are indications of the limits of the sets of muscle fibres in the wall, and are perhaps homologous with the *myotomes* in the fish. Cut the wall of the body cavity open and find the cavity within, draw the skin aside and note the pigmented *peritoneum* which lines the space. Follow the cut forward and as you reach the level of the front limbs note and dissect out the two pieces of cartilage which overlap in the midventral line, they are the *coracoid cartilages*. Draw them aside and pin them out of the way. They will be studied latter in connection with the front limb.

Cut away the coracoid cartilages and continue to open the body cavity forward to the throat. Follow it backward toward the cloaca, in doing so you will come to a similar ventral arch helping to hold the hind leg in place; note that it is bony, dissect off the muscles and skin so as to disclose the pair of bones, and cut between them;

push them aside and pin down, so as to fully open the
cavity. Note that there is *no diaphragm* subdividing the
body cavity into thorax and abdomen; note also the
mesentery, its thin delicate texture, and its continuation
out onto the body wall where it passes insensibly into the
peritoneal lining. In dissecting the contents of the body
cavity do not cut any of the organs away, till after you
have located and examined the relations of them all;
merely dissect them apart, and push them aside to see
underlying ones. After all the points have been noted
you can then cut out such as are necessary.

5. THE HEART is located in the neck very close be-
hind the head; it is next the ventral body wall and in
front of the level of the anterior limbs. In the construc-
tion of its interior it is also intermediate between the
single circulation type as in the smelt and the complete
double circulation of the bird or mammal. Remove the
pericardium; this will enable you to see the different parts
of the *heart* and some of its large *communicating vessels*.
There is in front a pair of *aortic arches* which lead out
from a distinct *bulbus arteriosus*. Posterior to the bulbus
is the *single ventricle*, it lies on the right side and some-
what ventrally to the auricles. There are two. auricles;
the veins from the body at large empty into the *right
auricle;* the blood from the lungs empties into the *left
auricle*. If the specimen is in a suitable condition cut
the chambers open and using a probe carefully trace their
connections both with each other and with the large
communicating blood vessels. Both auricles open into the
single ventricle (but in such a manner as to send the best
aerated blood to the head, and the poorest to the posterior
parts of the body).

[6. THE VASCULAR SYSTEM,—can only be adequately
dissected upon an injected specimen, but an outline
description is included here for convenience and a good

many of the vessels can be found. A single pair of *aortic arches* pass dorsally from the bulb and meet, as in the fish, to form the *dorsal aorta* which then runs down the body cavity in its dorsal wall and beyond into the post abdomen. Partial additional arches can be traced (in the frog) which lead out from the bulbus to the head *carotids* and to the lungs *pulmonary arteries, sub-clavians* pass from the dorsal aorta into the arms; in the trunk region there are *coeliac, mesenteric* and still more posteriorly *renal* arteries; at the level of the hind limbs there are *iliac arteries* going into them from the dorsal aorta; there is an artery running in the skin *cutaneous*, it arises from the subclavian and also from the iliac. Veins from the kidneys *renal veins* combine to form a vessel the *post-caval vein* (posterior vena cava) which runs close below the back-bone directly forward and into the hinder side of the right auricle. It receives vessels from the liver, *hepatic vein*, but none from the stomach or intestines. The blood from the iliac system, and muscles and skin of the post-abdomen is collected into a vessel of importance in the amphibia but of minor significance in the higher vertebrates, the *anterior abdominal vein*; it runs in the mid-ventral line closely related to the skin there, and enters the hinder side of the liver where its capillaries anastomose with those from the portal vein. The blood from the anterior parts of the body returns to the heart through *jugular* and *sub-clavian veins*, which contribute to form the *pre-caval vein*, entering the right auricle. Thus all the systemic blood is returned to the right auricle. The blood from the lungs, is returned to the left auricle by *pulmonary veins.*]

7. THE ALIMENTARY VISCERA.—The *liver* is the most noticeable organ of the system; it lies in the mid-ventral line directly behind the heart, and reaches back more than half way down the body cavity. On its posterior

border the *gall bladder* can be seen. By drawing the liver aside, the *gullet* can be seen dorsally to the heart; the *stomach* is a fusiform enlargement in the course of the alimentary tube which passes insensibly into the *small intestine*. The latter is somewhat longer than the body cavity and hence is winding in its course; the *mesentery* can be seen clearly on its dorsal side and *portal vessels* are recognizable. At the upper end of the small intestine you can find the *bile-duct* running into it from the gall-bladder; and in the mesentery near by there is a diffused mass of *pancreatic tissue*, whose ducts open into the small intestine. The *large intestine* directly follows the small intestine, is not sub-divided into parts but has the form of a short rectum passing directly to the *cloaca*.

8. THE LUNGS are a pair of elongate, slender thin-walled sacks; blind posteriorly, they come together in front and above the heart where they open into a passage which leads to the *glottis* already noted in the hinder part of the mouth chamber just behind the tongue. In the higher vertebrates this air tube (*trachaea*) is lined with cartilage, but it does not appear to be so in the salamander. The passage can be demonstrated by passing a guarded bristle down through the glottis. The lungs should be cut open to show that the interior is a very simple sack with only a beginning of that elaborate sub-division into spaces found in the mammal. The walls are reddish, this indicates the presence of blood vessels in contrast with the colorless wall of the swim bladder of the smelt; but to prove that the wall is vascular mount a thin film of it and examine with the compound microscope. Do you find any blood corpuscles there?

[This and the reptilian lung are simple conditions of the lung of which the bird and mammal lung are very highly specialized conditions. The circulation and respiration.

of the adult amphibian are decidedly different from that of the young: in the latter the blood is pumped through gills and thence directly to the body, as in the fish so that the circulation is a "single circulation," with the loss of the gills after the maturity has been reached the double circulation, and respiration as here described, are established. In reptiles, birds and mammals the same is true of the circulation but in their cases the single circulation is confined to stages that precede free and independent life, i. e., are purely embryonic. (In some amphibia e.g. *Necturus* respiration is both pulmonary and branchial throughout life.]

9. THE URO-GENITAL SYSTEM.—Cut off and remove the various viscera already examined (after making drawings necessary to record the facts) taking care not to damage the remaining organs in the body cavity. The reproductive organs vary considerably with sex and season. In the breeding season the ovaries are filled with black *eggs* which are greatly in the way in dissecting, and the oviduct is much enlarged by the formation of the large amounts of albuminous matter in which the eggs are "laid." These latter will not of course be confused with the alimentary tube by a careful dissector. The paired kidneys are divided into two parts: a hinder portion of more compact texture *meta-nephros*, lying near to the cloaca and next the dorsal body wall; and in front of this a long *mesonephric part* which runs forward on either side and reaches the anterior level of the body cavity, close to the dorsal body wall. There is a *urinary bladder*; it is thin-walled, and located below the rectum between it and the body wall, in the most posterior part of the body cavity. Its size varies greatly in different specimens. Ducts (*ureters*) from the kidneys lead into it and there is a passage *urethra* leading from it to the cloaca.

The *ureters* pass down on the outer side of each meso-

and meta-nephros; in some cases they are very conspicuous; they unite below the meta-nephros to form a single passage which leads into the bladder on each side. In the higher vertebrates the kidney is a compact organ and the ducts coming from its various parts all unite to form the single ureter before they leave the boundary of the organ.

The *spermary* in male specimens is a compact organ on the level of the meso-nephros; its ducts pass into the ducts from the meso-nephros and thus reach the exterior through the ureter*; in the female there is a duct *ovi duct* which lies beside the ureter, and is separate from it, this runs way forward to the neck where it opens by a broad funnel shaped orifice directly into the body cavity; near this opening of the ovi-duct lies a large glandular organ the *ovary*, the ova when they escape from the ovary find their way into the oviduct at its open end and then collect there to produce the appearance described in the beginning of this paragraph. They finally escape through the cloaca into which the ovi-duct ultimately opens.

10. THE MUSCULAR SYSTEM.—The skin should be removed from the body and at least one of the limbs to determine the following points; the muscle fibres will show much more distinctly after preservation in alcohol or after boiling. The system as a whole includes : the muscles connected with the viscera *involuntary muscles* ; and the muscles attaching to the skelton and used in changing the form and position of the body, *skeletal muscles*. Of these latter we may distinguish those of the *head*, and those of the (rest of the) *body*. It is to the latter that the present study is mainly confined. Two kinds are reconizable : those of the spine used in producing the bendings of the back-bone, *spinal muscles*; and

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*Besides the spermary there it generally in the males a organ on each side resembling is but composed mainly of fat called the corpus adiposum.

the *limb muscles*. The spinal muscles are plainly homologous with those of the teleost; for they are similarly located. In the post-abdomen they make up the bulk of the flesh and are closely related to neural and haemal spines; and in the trunk they are related to neural spines dorsally while ventrally they compose a large portion of the wall of the body cavity. They are also segmented, each myotome being made up of short fibres parallel in their arrangement and corresponding precisely with the number of the vertebrae. The limb muscles are relatively insignificant in the salamander whose limbs are small, though really much used, but they are homologous with the very important limb muscular system as it exists in its highly elaborate state in the mammals. The exact identification of the muscles of the limb will hardly be possible in this course, but a number of points can be made out. The muscles are seen to consist of a muscular central portion the *belly*, and at the end a *tendon* which in some cases is quite long.

The muscles have two points of attachment, one the *origin* nearer the back-bone; a distal one the *insertion* farther from the spine. The shortening of the muscle causes it to pull on its tendon and thus to move the bones on their joints. The muscles are placed on opposite sides of the limb so that some bend or *flex* it, while others *antagonize* these and *extend* it again.

11. FINE STRUCTURE OF STRIATED MUSCLE.—Cut out one of the small muscles of the limb, place it on a slide, surround it with glycerine, tease it carefully into its component fibres, taking care not to twist them; after spreading the muscle out as well as possible, cover and examine with a low power. You can now recognize more clearly that the organ is made up of parallel short pieces, imbedded in a network of minute fibres of *white fibrous connective tissue*; trace these latter toward the *tendon* and

note that they alone compose it, the muscle fibres disappearing at the end.   Examine single fibres with a high power, and recognize, that they are composed of still smaller *fibrillae* which run lengthwise in the fibre; that there is a sheath enclosing the fibre, *sarcolemma*; that the fibrillae are marked with lines crossing them at equal distances, and that this gives to the fibre a cross-marking, *striation*.   Directly beneath the sarcolemma there are elongate granular *cell-nuclei*, these may not be easily recognized in the glycerine preparation unstained.   If so stain a second preparation before the application of glycerine with borax carmine, decolorize with acidulated alcohol and examine small fibres for nuclei, note their exact size and position with reference to the fibre.

12.   The Nervous System.—In dissecting the dorsal wall of the body cavity next the spinal column you have probably noted white threads running in the lines between the myotomes outward from the spine, these are the *spinal nerves*.   A pair can be seen at the interval between each two vertebrae through the entire length of the trunk, and they are also present in the post-abdomen in the same way, though not there so easily traced; there is thus a metamerism in the nervous system.   The spinal nerves are of approximately the same diameter throughout the series excepting at the levels of the front and hind limbs, where several of them are considerably larger than the rest, this is because they are composed of the additional fibers that go to the muscles and skin of the limbs.   How many of these nerves to the limbs do you recognize ?   In the head there is a series of *cranial nerves* which relate the parts of the head with the brain; as in the fish, the spinal canal lodges the *spinal cord* which can be seen by removing the neural arches. There is a *sympathetic system* but its dissection is very difficult.

13. THE AXIAL SKELETON.—After setting aside the limbs, clean the back-bone in a specimen which has been boiled to soften the muscular tissue, removing all the flesh by picking it away or with a brush. Take care not to dislocate the bones and especially not to loosen the very rudimentary ribs in the trunk region.

Note the series of vertebræ running from the head to the tip of the tail. They are less similar in different parts of the column than in the fish; being differentiated into regions to some extent though less markedly than in the birds and mammals. In the neck *cervical* region, an *atlas* articulating with the skull and an *axis* next behind the atlas are present. Behind these come the vertebræ of the *trunk*, which correspond with the *dorsal* and *lumbar* series of mammals; a single *sacral* vertebra follows and to it the pelvic girdle is attached ; this in turn is followed by the *caudal series*. Count the number in each of the regions and compare with other individuals to determine the degree of constancy of the number.

Any of the trunk vertebræ can be examined as a representative case. It presents a *centrum*; a *neural arch*, bearing a spine and the *zygapophyses*; a bi-furcated *transverse process* is carried by the centrum on each side; to which the rib when present is articulated. Tranverse processes are wanting in the *atlas* and *axis*; and the neural spine is unlike that of the rest of the series; the axis bears a prominence in front of its centrum, the *odontoid process*. The sacrum is like the others but has much enlarged tranverse processes. The caudal series is much compressed; there is a series of *chevron bones*, the hæmal spines; and the accessory parts gradually fade out and disappear posteriorly till nothing but the centrum is left. *Ribs* are present articulating with vertebræ in the neck as well as in the dorsal and lumber regions, so that the differentiation as in the mammals is not found here; the ribs are rudimentary and do not run out onto the body

wall to any considerable distance. Compare this skeleton if possible with that of a dog, cat or any other mammal.

14. THE SKELETON OF LIMBS.—Remove the skin and muscular tissue so as to display the bones of the limb and note the position size and shapes of the bones as follows. The front limb is not directly articulated to the body but at the *shoulder joint* to a plate of bones and cartilage forming the *shoulder girdle*, this consists of two portions: one is dorsal, the *scapula*; it consists of a small elongate bone dorsal to which is a cartilaginous plate the *supra-scapula*, the other on the ventral side is a large plate of cartilage which meets and overlaps its mate of the opposite side, *coracoid cartilages*. These each present a broader hinder *caracoid* proper and a smaller anterior *pre-coracoid*. In the hinder angle between the two coracoids a small *sternal cartilage* is found. These elements of the *shoulder girdle* meet and form a cup-shaped *glenoid* cavity into which the bone of the upper arm is articulated. There is a single bone the *humerus* in the upper arm. In the middle-arm there are two bones, one the *radius* on the inside, the other the *ulna* on the outside of the arm. There are four digits in the hand which correspond with the outer four in the human, examine them and locate and count the small bones *phalanges* of which they are composed. Carefully dissect the wrist region and find the small *carpal bones*, determine that there are two rows: one *distal row* at the bases of the digits; and a *proximal row*, articulating with the end of the radius and ulna. As the bones of the carpus are similar in all the vertebrates their nomenclature is given here. Three are recognized in the proximal row, viz: *ulnare, intermedium* and *radiale*; four in the distal row viz: *carpalia* 2, 3, 4 and 5 articulating with the digits 2, 3, 4, and 5 (the first being abortive). One more in the centre of the carpus the *centrale* complete the list.

Dissecting in the same way the hind limb, determine its various bones. There is a *pelvic girdle* attaching the limb to the body; this is directly articulated with the spinal column, the point of attachment being on the sides of the *sacrum*. There is a cavity *acetabulum* into which the upper limb bone of the leg fastens, formed by three bones passing: one dorsally the *ilium*: a second ventrally and in front, the *pubis*; and a third ventrally and behind the *ischium*; all three meet in the acetabulum. The two ventral bones meet in the mid-ventral line and compose an arch, the pubic arch, between which and the back-bone the rectum and the uro-genital organs pass to reach the cloaca.

The *femur* is the single bone of the upper limb *thigh*. In the *crus* there are two bones, *tibia* and *fibula*; they are of the same size; the outer is the fibula; there are *five digits*, locate and count their bones; examine the tarsus, it has the same composition as the carpus, i. e. a proximal row, *tibiale, intermedium* and *fibulare*, centrale and distal *tarsalia* 1, 2, 3, 4, and 5.

15.   THE BONES OF THE SKULL.—The skull of the salamander is somewhat small for study of the bones and that of a large frog is much the same and should be used in its stead if obtainable. The brain case is enclosed below by cartilage, *sphen-ethmoid*, which in the higher vertebrates ossifies in two parts: the *phenoid* bone behind and the *ethmoid* bone in front. Dorsally, the brain is covered by the *frontal* bones in front and the *parietal* bones behind. Below the sphen-ethmoid cartilage is a dagger shaped para-sphenoid bone (not found where the sphenoid and ethmoid are ossified). At the hinder end of the brain-case the nervous tissue emerges through an opening the *foramen-magnum*; this is the *occipital region* of the skull but remains cartilaginous in amphibia except where it articulates with the spinal column, here bones

the *exoccipitals* are developed.   Bones reach out from
the brain-case and support the different parts of the face,
posteriorly are the *auditory capsules* surrounding the ears;
when bones are developed in this cartilage they are
called *otic* bones and in the frog *pro-otics* are formed on
the anterior side of the cartilage. A mass of cartilage
quadrate cartilage reaches from the occipital region side-
ways as far as the angle of the jaw. A bone the *pterygoid*
ossifies in connection with this. It reaches forward and
helps to form the upper jaw. It also rests against the
sphen-ethmoid cartilage.

   Another bone related to the hinder part of the skull is
the *quadrato-jugal*, this forms the hinder outer angle of
the head, and the *glenoid cavity*, where the lower jaw
articulates, is located in it. The arch running forward
from the quadrate forming the hinder part of the upper
jaw is called the *zygomatic arch* the space between it and
the brain case is the *orbito-temporal fossa*, and lodges *the
eye*, in front and the *temporal muscles* (used in closing the
lower jaw) behind. Continuing on the line of the upper
jaw, you will find next in front of the zygomatic arch
a slender portion of the *maxillary bone*. This bone presents
two other portions; one on the roof of the skull and be-
hind the nostril, the *facial portion;* and a second part
which runs in and forms a part of the roof of the mouth
chamber, in front, the *palatine portion*. The middle of
the upper jaw is formed by the *pre-maxillaries*, which
also form the lower border of the nostril. The *nasal
bones*, run from the premaxillaries to the frontals in the
middle line of the roof of the skull, and are located pos-
terior to the nostrils. Small bones, the *pre-frontals* com-
plete the closure of the nostril. In the roof of the mouth
there are in front two large flat bones, *vomers* and crossing
the capito-temporal fossa. Between the vomer and the
maxillary are the *palatines*. The lower jaw is composed
of cartilage in early stages but in adults a number of dif-

ferent bones are formed in the membranes which invest this original *Meckel's cartilage*, often however leaving some remnant of the cartilage even to the very end of life. Of these the *dentary* is the central one bearing teeth, the *angulare* the one bearing the articular face and meeting the quadrate.

EDITORIAL.

Peroxide of Hydrogen.—We are very glad to call attention to the article of Mr. C. E. Hanaman on pages 7, 8 and 9 describing his experiments and the use made of the peroxide. We trust that others will report upon the use of this antiseptic. In his letter transmitting the article Mr. Hanaman writes: "Altogether the specimen is one over which many hours of profitable study may be spent, and I trust that this article may induce others to experiment in the same direction, and if possible improve upon the process. I do not think the bleaching process can be very much improved but there is ample field for experiment in the direction of fixing fluids with penetrating power sufficient to pass quickly through chitin and of selective staining agents with the same powers.

Microscope Wanted.—One of our subscribers (W. C. P.), wishes to buy an instrument,—student's Van Heurch preferred. Send offers marked "No. 1290" to us for his consideration.

Barbados Earth.—We have a small quantity left of the supply of Barbados earth so kindly given to us, for distribution, by Mr. Bryce Scott of New Brunswick. Send stamped envelope.

Richard H. Oakley, 2227 Wilson avenue, Cleveland, Ohio, has slides of Sycamore, double stained which he wishes to exchange for slides of diatoms, ferns or mollusca odontophora.

MICROSCOPICAL APPARATUS.

Attachable Mechanical Stage for Microscopes With Plain Stages.—This Stage consists of a suitable base-plate provided with thumb-screws fitting into the clip-holes and fastened from below. Upon the base-plate are two sliding

MECHANICAL STAGE.
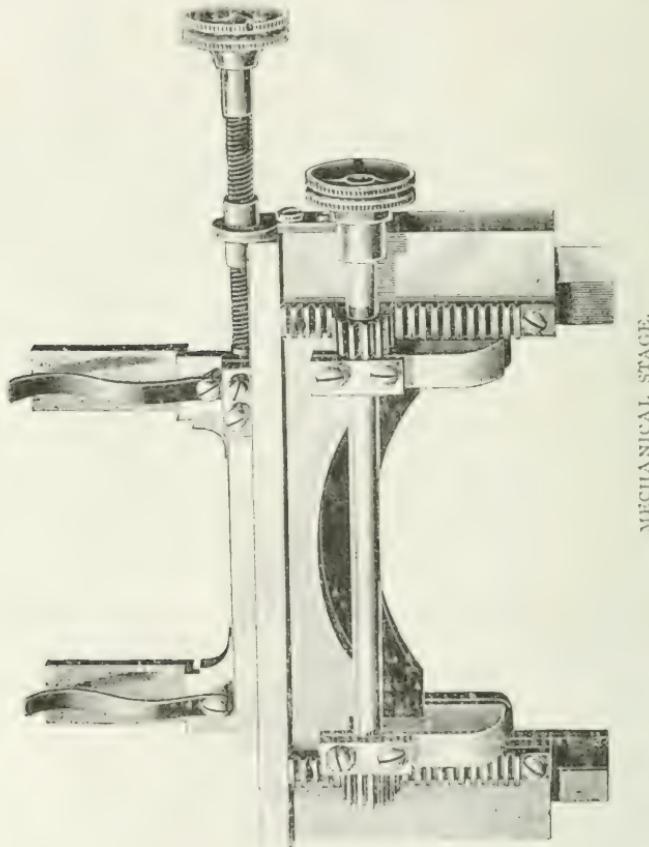
pieces mounted at right angles to one another and moved in right lines by two milled heads. The perpendicular movements are controlled by rack and pinion, and extend an inch and a quarter. The horizontal movements extend full two inches and are controlled by a micrometer screw. These sliding pieces pass along suitable scales whereby

any particular position may be recorded and found again easily. The object is in a simple carrier close to the surface of the stage. The mechanical stage can be fitted to any stage if the location of the clip-holes and center of the stage is known. It is sold by Zentmayer for $16.00.

MICROSCOPICAL MANIPULATION.

To Distinguish Guaiacol from Beechwood Creosote.— Mr. Vreven utilizes the following method for distinguishing beechwood creosote from liquid guaiacol: He places a few drops of the substance under examination in a test tube and adds 2 or 3 drops of ether and 1 or 2 drops of concentrated nitric acid or of concentrated hydrochloric acid and agitates the mixture. There is first of all a reddish brown coloration produced in the ethereal layer. After spontaneous evaporation of the ether there remain oily drops if the substance on examination is creosote, or if it is liquid guaiacol the residue is in the form of crystals. Sometimes crystals are not produced even if the substance examined is liquid guaiacol unless the residue is agitated, but upon agitation the crystals appear immediately. Under the same conditions carbolic acid also yields crystals, but their form does not at all resemble the form of crystals produced by guaiacol, the crystals of the latter consisting of needles aggregated in the form of stars which are very easily distinguished under the microscope.—American Druggist.

New Method of Purifying Water.—The French Academy of Sciences appears to indorse the new method of purifying water by calcium permanganate and manganese dioxide. According to this method, the calcium permanganate coming in contact with organic matter and microorganisms, destroys them and decomposes itself into oxygen, manganese oxide and lime. Then, to carry off the surplus of permanganate and complete the purification, the water is poured over managanese dioxide; oxygen in the nascent state is thus freed and it burns up any remain-

ing germs. There remain in the apparatus, then, inferior
oxides of manganese, which hasten to re-oxidize themselves
and furnish again a certain quantity of manganese dioxide;
the water as thus finally purified contains a little lime in
the form of bicarbonate and traces of oxygenated water.
A very small quantity of calcium permanganate is used in
this process, and, if practicable on a large scale, is of great
importance. Water having 100,000 colonies of microbes
can thus be purified, it is stated, and ice placed in water
with calcium permanganate is also quickly sterilized.—
American Druggist.

BACTERIOLOGY.

The Microbic Character of Acute Catarrhal Otitis Media.

Lannois concludes from his observations that: 1. The
normal middle ear in animals acts like an aseptic cavity
and contains no micro-organisms. 2. The liquid of catarr-
hal otitis media does or does not contain microbes, accord-
ing to the period at which it is examined after the begin-
ning. 3. The disappearance of the microbes is sometimes
probably due to the bactericidal power of the mucous mem-
brane and the mucus. 4. The bactericidal action explains
why the secretion rarely becomes purulent, even after
paracentesis and repeated catheterization.

MICROSCOPICAL SOCIETIES.

Sheffield Microscopical Society.

Friday, December 18th, Mr. G. T. W. Newsholme,
Honorary Secretary, in the chair.—The President, Mr. A.
H. Allen, lectured on "The Philosophy of the Microscope."
He explained that he had chosen that subject because some
people were at sea as to the optical principles involved in
the use of the microscope. He reminded the gathering
that we do not see light in the ordinary sense, but perceive
it when it falls on something capable of reflecting it, and so
reaches the eye. Another principle to which he called at-

tention, is that an object always appears to be in that direction in which the rays of light last reach the eye. It was, Mr. Allen said, a highly important principle, which was sometimes not so thoroughly borne in mind as it should be. Mr. Allen then described the laws of optics utilised in the construction of the microscope, illustrating his observations by numerous demonstrations carried out by means of a beam of light. He also explained the magnifying power of different object glasses and eye-pieces, and dealt in a chatty but interesting and instructive way with other details connected with the optical construction of the microscope.

Liverpool Microscopial Society.

"The Microscopic Study of Cotton and other Fibres," was the subject which Mr. F. H. Tate, F.C.S., discussed before the members of the Society recently. The paper dealt principally with cotton, and described the structure, mode of growth and development of the fibres. The different structures of the plant were exhibited by lantern illustrations and their several characteristics were explained. Micro-photography was relied upon to reveal the difference between healthy and diseased fibres. The fibres of other materials, as wool, silk, flax, etc., were similarly described and exhibited.

Quekett Microscopical Club.

The 346th ordinary meeting of this club was held on Friday, Nov. 20th, at 20, Hanover-square, Mr. J. G. Waller, president, in the chair. Mr. T. Rosseter, F.R.M.S., read a paper on a new Cysticercus and Tænia. The former infests the entomostracan, Cypris fusca, and the mature tapeworm develops in the common duck. Mr. Rosseter gave a most interesting account of his experiments in feeding the birds with the entomostraca, his frequent failures, and final success. The paper was illustrated by drawings of the various stages and details of structure, as well as by diagrams on the board. In moving a vote of thanks, the president remarked that Mr. Rosseter appeared to be the sole investigator of these parasites, so far

as birds were concerned, in this country; it was a wide
field for those possessing the opportunity of study, and no
doubt a great deal remained to be discovered. The vote
was carried with applause. Mr. C. D. Soar exhibited a
series of 41 beautiful drawings of Hydrachnidæ collected
at the club's excursions during the past season, and gave
a commentary on the life-history of the water mites in
general. Many of these mites are most georgeously
colored and marked, and the series was much admired.

Quekett Microscopical Club.

The 347th ordinary meeting of this club was held on Fri-
day, December 18, at 20, Hanover-square, Mr. J. G. Waller,
F.S.A., President, in the chair. After the usual formal
business, Messrs. Swift exhibited a double perforated
stop for affixing cracker gelatine in experiments with
color-ground illumination, to fit the diaphragm carrier of
the Abbe or other similar condenser. Mr. W. Stokes
read a paper "On Multiple Images in Mirrors," illustrated
by diagrams. For the removal of these images Mr. Stokes
advocated that microscope mirrors should be ground about
$1°$ from parallelism when, on rotating the mirror in its cell,
the images from the reflecting surfaces would superim-
pose in a certain position, and so merge into one. A paper
"On a New Form of Sub-Stage Color Illuminator," by Mr.
J. Rheinberg, was read for the author by Dr. Measures.
It was shown that the color contrasts obtainable with this
instrument were practically unlimited. A discussion fol-
lowed. Mr. Nelson read a "Note on Some New Lenses,"
pointing out the fallacy of the term "aplanatic" as applied
to the ordinary triplet magnifiers. Votes of thanks were
given for these several communications, and the proceed-
ings terminated.

It is stated that Mr. C. R. Bishop has authorised the
the trustees of the Bishop Museum to expend 750,000 dol-
lars in building an aquarium and marine biological station
at Honolulu for the study of marine life in the Pacific.
Prof. W. T. Brigham is prepared to complete the plans.

MICROSCOPICAL NOTES.

Murder.—At a small town near Pittsburg, Alex. Killen was charged with robbing and murdering a woman who had owned a jewelry store. The culprit had broken a window and scraped the jewelry into a yellow satchel. In the haste some glass was included.

After Killen's arrest, such a satchel was found on his premises and some small pieces of glass found in it. At the trial, the District Attorney laid them on a sheet of paper and passed them to the jury. This was not satisfactory—a powerful microscope was brought in and each juror examined the bits of glass. A glass worker on the jury was satisfied that the bits were from window glass and not from a bottle which Killen said had been broken in the satchel. The other jurors accepted his suggestions and convicted Killen of Murder in the first degree—circumstantial evidence adduced by the use of a microscope.

Distribution of Fungi by Snails and Toads.—Voglino communicates a suggestive paper to the *Nuovo Giornale Bot. Ital.* (1895, 181), in which he demonstrates that certain fungi (Agariciniæ) are distributed by snails and toads. An examination of the stomachs of the snails and toads. presence of the spores of various species of fungi which were seen to have begun their germination, and culture experiments with the excrements of various snails produced a large number of germinating spores of fungi. The same was observed on examining the stomachs of toads, in which the spores of Russula and Lactarius were specially abundant.

Honey Bee Secretes Fromic Acid.—A fact which is interesting and perhaps new to many, is that the honey-bee after filling a cell with honey and covering it with the lid, adds to the honey a drop of formic acid. This is done by piercing the lid with the sting and depositing a drop of the poison from her sack. By numerous experiments it has been shown that formic acid added to honey or any sugar

solution prevents fermentation. Evidently the sting of
the bee has a use besides that of defence.

The Management of the Journal of Nervous and Mental
Diseases announces the following arrangement of the staff
for 1897: Dr. Chas. L. Dana, Dr. F. X. Dercum, Dr. Philip
Coombs Knapp, Dr. Chas. K. Mills, Dr. Jas. J. Putnam,
Dr. B. Sachs, Dr. M. Allen Starr, as editors. Dr. Philip
Meirowitz, Dr. Wm. G. Spiller, as Associated Editors. Dr.
Chas. Henry Brown, 25 West 45th St, New York, is Man-
aging Editor.

Dr. George M. Sternberg, Surgeon General of the
United States Army, has received the honorary degree of
LL. D. from Brown University.

Dr. W. E. Castle has been appointed instructor in biology
in Knox College, Galesbury, Ill.

RECENT PUBLICATIONS.

Mystic Masonry, or the Symbols of Freemasonry and
the Greater Mysteries of Antiquity.—By J. D. Buck, M.
D., Cincinnati: Robert Clarke Co. 265 pp. XIV pl. 12mo
$1.50.

This little book is a compendium of occult knowledge.
The world at large will not comprehend it. Most people
will not wish to do so. It will fall only into the hands of
those who are somewhat curious regarding that which
underlies and is greater than all religions and all fraterni-
ties. I am not a freemason but if tomorrow I had to part
for life with two of the following three books: Shakespeare,
The Bible, Buck's Mystic Masonry—I would keep the lat-
ter and let go the other two in spite of the mystic meaning
which I now know to be concealed in the two former books.
My reason is that I can remember much that is in the
Bible, and not a little of Shakespeare but this book is new
to me and contains the keys to all knowledge. I risk this
assertion although I know that the declaration itself will
mystify nearly all who read it.—C. W. S.

HAND OF MUMMY, 3,000 YEARS OLD, TAKEN
BY W. WATSON & SONS, WITH THEIR
RONTGEN RAY APPARATUS.

Studies in Diatom Biology.

By K. M. CUNNINGHAM,

MOBILE, ALA.

During the month of November, 1895, I had an oppor-
tunity of securing a very interesting gathering of living
diatoms under the following conditions. On one of my
excursions I incidentally noted that the surface of a ditch
used for transporting saw logs through a marshy flat, was
covered with a thick and uniform layer of greenish scum,
and that it was accidentally banked up at the point, by a
boat paddle arresting its passage along the ditch. The
winds were driving further supplies of scum to the ob-
struction across the ditch. A momentary inspection in-
dicated that there was a very rich accumulation of dia-
toms. I secured a pint or so of the material for treat-
ment and study. The chief or most numerous form oc-
curing in the gathering was Nitzschia scalaris, which
species, as is well known, is among the largest of the
prism-like forms commonly encountered all over the
globe, and is associated with fresh or brackish waters.
By availing myself of the aid of this special form in its
living state, I was enabled to prosecute some studies tend-
ing to give additional importance to the hypothesis that
this diatom belongs biologically to the protozoa rather
than to the plants. I shall indicate by what line of reas-
oning I venture to present this view to the attention of
those who are interested in biological studies.

As a primary fact, we may assert that when a portion

of the material is gathered in its densest state, it is intro-
duced into a suitable bottle, and the diatom contents are
allowed to distribute themselves in the water. It is soon
evident that many of the motile forms in the bottle are
attaching themselves to the inside surface of the bottle
and continue their motions incessantly in any chance di-
rection. If now while having a bottle of this kind under in-
spection, as simple an apparatus as a common five cent
lens, of a quarter inch focus will enable anyone to follow
the motions of the large Nitzschia scalaris in its wander-
ings while in contact with the glass surface. This fact
alone would be *prima facie* evidence of its having some
organ adapting it to auto-locomotion, and that in a par-
ticularly striking manner. The same simple aid will
also show that if one extremity of the prismatic body of
the Nitzschia should become detached by shaking from
contact with the side of the bottle, leaving but one end
adherent, the end in contact still may have sufficient
motive power therein to propel itself along the glass,
and when a Nitzschia is thus moving around, it can be
followed for hours, if the observer is so disposed.

This is the simple character of an initial study that
might have been made by Leewenhoeck in his day, with
credit to himself for whatever his observing mind might
have noted in relation thereto. If now, however, the
conditions under which we view the Nitzschia be modi-
fied, we may find a new series of phenomena that would
have been totally overlooked in the experiment noted
above. If during the study we transfer a dip of the dia-
tom material covering some of the Nitzschias to a glass
slip, and cover the same with a cover glass and view the
living frustules with the aid of a 1-6 objective, then the
peculiarities of locomotive and motile effects may be very
readily observed. A close study will verify the fact that
the Nitzschia has a distinct movement; not merely of
progression or change of place in a rectilinear path, but

also that the entire epidermal coat may be actively engaged in gathering up any character of minute mineral or other debris along its path. Such particles as become attached, are independently moved from numerous centers of vital action. This is as if the epidermal surface at any given point had a retractile and contractile power, independent of any other given point of vital action along the frustular surface. The motile functions consist of the power of transporting small mineral particles such as sand grains and vegetal debris for appreciable distances along its edges or surface, and of rejecting them and substituting new particles. The particles may be jerked up at any point and carried indifferently in a positive or negative direction from the point of attachment, until these particles are replaced by new ones. It should strike any observer who may verify these phases of action that such phenomena point to a more complex cilia-like function than that which may be noted in the ciliary fringes of an oyster or clam. The latter cilia motion lashes and drives the particles in a general direction or current. The complicated system of moving particles can also be followed in its interminable variations as long as it may suit the convenience of the observer to change the specimen of Nitzschia under observation, on account of its relatively conspicuous size. Nitzschia scalaris is a very satisfactery species in which to study the character of its vital movements.

The internal frustular contents present an abundance of globular bodies of varying sizes which have a constant independent motion among themselves, that is, their juxta-position is seen to be constantly changing when very carefully noted.

Nitzschia scalaris when viewed under a power of 500 diameters is longer than any other of the North American specimens of the bacillar forms, and therefore can be

observed with ease in verifying what is said herein in reference to its intricate motile powers.

In further studies of Navicula nobilis and firma, with the view to verifying the results obtained by a former contributor on the subject of the movements of diatoms, I made use of methyl-blue to differentiate the epidermal covering or mantle, by the following methods. From a rich gathering of living Navicula nobilis, firma and Surirella biserriata, and other forms, I transferred a drop to a slip, and observed them with a ½ inch objective. By this means I was enabled to note that as many as twenty forms of N. nobilis and firma could be found in parallel contact at one and the same time, gliding back and forth in contact with each other, somewhat after the manner that colonies of Bacillaria paradoxa move at times. While having this special gathering under study in order to note the character of the epidermal envelope, it became relatively easy to note the amount of separation between two or more touching frustules of the surrounding transparent layers. Now, admitting that the external layer, if it exists at all, must have the character of an albuminous substance, such as the white of an egg, the substance ought to coagulate under a boiling temperature, and take on an altered or fixed state the same as the white of an egg does when boiled sufficiently. By shortly drying such a slide of living diatoms over a students' lamp flame, and completing the mount with thin balsam, we find that the epidermal covering has been changed to a practically impervious envelope. The thin balsam failed to penetrate many of the frustules during a period extending over months. The slide on examination perodically showed the frustules to be filled with air, and the shrunken or contracted threads of endoplasm still showed a strong greenish tint in the air filled spaces. On the contrary, it is well know that, in acid-treated diatoms of like character, there is almost an immediate ex-

pulsion of air from the frustule, and a substitution of the balsam in the air spaces. If these phases of study are accurately construed, we have a demonstration of the presence of enveloping substance on the exterior of the silicious frustules without resorting to staining tests for a like purpose.

Continuing this investigation, I made an attempt to differentiate the protoplasmic mantle with the aid of dyes in order to verify an experimental study recorded several years ago by C. Onderdonk and published in this journal. While I failed to duplicate what was stated therein, I found a wide range of interesting phenomena throwing light on the structure of the living diatoms. By placing a drop of water with numerous large Naviculæ on a slip and covering it with a ¾ inch cover glass, and then placing in contact with the edge of the cover-glass, a minute grain of crystalline methyl-blue, the dye was speedily diffused from the edge of the glass and passed slowly across the fluid field. Then it was a very easy matter to steadily observe for protracted intervals the action of the dye, as its influence reached the living frustules. For example, the stain was absorbed by the frustule both inside as well as outside, some time before it was perceptible in the thin layer of liquid; and more markedly absorbed by the internal protoplasmic granules when the dyeing action became more evident. The evidence of a strong irritation on the part of the frustule is readily observed as it quickly loses the power of direct axial motion and swerves irregularly and spasmodically at alternate ends, unable to advance in its normal manner. It may even spin around in its own length, the power of controlling its normal traveling motion being in a manner paralyzed. At least this would be the probable interpretation, that any observer would identify with an irritating toxic substance acting on organisms having a determined or even conjectural nervous system

or a cellular structure to which poisons would be deadly
in their effect. The process of encroachment of an aniline
dye and its lethal results may be studied with equal in-
terest in the smaller Naviculæ as in the larger. There is
the same activity of irritation and arresting of locomo-
tive power, and finally the death of the bioplasmic
power, whether inside or outside of the frustule. For
those who could find interest in the death struggles of
vertebrate animals, as seen in the case of Spanish bull
fights, or the asphyxiation of dogs during the canicula,
might be found plenty of mental excitement in following
the death throes of a diatom from start to finish, under
the method of drowning in a weak aniline bath.

After having had sufficient familiarity with the phases
leading up to the extinction of the life process of a series
of living diatoms in the field of the microscope, it would
perhaps be repugnant to the student to admit that he has
been witnessing vital phenomena characteristic alone in
its nature of plant or vegetable life. These forms have
heretofore been deemed too insignificant to warrant for
them a place among the Protozoans; the fundamental or
simplest class of animal life which modern science has so
far been able to trace.

By varying the dyeing tests with a substitution of com-
mon violet writing ink, I found features not observed dur-
ing a lengthy study with methyl blue. When the violet
stain reached the Navicula, I noted that what appeared to
be a sort of vermicular festoon was formed from the man-
tle or surface of the frustule, and the vermicular shreds
broke off and drifted away leaving some strands adher-
ing to its sides and small villous tufts at each end of the
frustule. This seemed to represent to me, what C. Onder-
donk described as the mantle expanding or crinkling
up like folds of cloth around the edges of the frustule.
Apart from this, I found nothing that I could identify
as that which he stated he had repeatedly verified in re-

gard to a differentiation of the mantle (ectoderm) envelop-
ing the navicular forms by the use of methyl green. I
had stained slides richly strewn with living diatoms up-
on which I made my observations and, on drying, the
frustules were examined superficially with condensed
light, and otherwise, only to find that the frustules gave
off the metallic sheen of the dye, with the sculptural
markings showing clearly; but the frustules were sur-
rounded where in contact with the slip by a crystalline
fringe of the methyl blue. They then simulated what
might be construed as a sort of ciliary projection. This
makes any deduction with reference to the mantle from
this mode of study an unknown quantity. The essential
points of C. Onderdonk's paper in relation to the mantle
of the diatom, and a conjecture touching the seat of the
vital function controlling its motile power, were adopted
by Wolle in his Diatomaceæ of North America. Therein
the marvelous phenomena of the diatom's power to handle
and rush grains of sand, as often as its necessities may
require it to do so, is entirely overlooked. I allude to
the portion of the work upon the "Motion of Diatoms."
This function of the diatom to gather up and transport
mineral particles energetically, is one that can be readily
verified with the aid of a 1-6 objective. No one need
miss it. The study involves no difficulties.

W. A. Terry, an expert student of the living diatom,
has frequently made allusions to the peculiarities of mo-
tion observed by himself, and from sources of supply that
I have never had an opportunity to inspect, he has re-
cently put on record the statement that some of the very
large living Amphiprora observed by him might pass
for vegetables but never for plants. As it was not his
object to seek for data to establish the Protozoan nature
of the Diatom his observations were not sufficiently crit-
ical to contribute to a formulary of expression adapted to
animal biology. He had incidently noted that a vigorous

diatom had tractive power sufficient to push or pull a mass of obstructing matter equal to its own bulk or even greater. In connection with these remarks, it may be proper to relate that he has recently been cultivating or growing the living forms and kindly offered to mail to me a culture sample. But we feared that they would not arrive in good condition if sent.

Acting on a suggestion derived from H. L. Smith's work in relation to the action of alkali on the protoplasm of the living frustules in an experimental way, I found that if a mounted slide of living diatoms was immersed in strong white soap solution and set aside for about twenty-four hours, all the frustules containing the living endoplasm were burst asunder into numerous small fragments, and the greenish contents were driven out and distributed in rills over the slide. This also showed that sutural lines are weak points in the frustural box.

In an attempt to clean a considerable quantity of material, from which the studies of Nitzschia scalaris were made, by boiling in a pearline solution, the result showed that the recent species had become badly distorted by a partial solvent action, and a softening of the silex. This I had never previously noticed in acid treatment, but I had been aware of the necessity of using the alkalies cautiously in one stage of the cleaning process.

Those who undertake to solve for themselves the mysterious cause of motion in the diatoms, will be confronted with a species of phenomena of the most puzzling interest. If the living diatoms have been retained in the same bottle of water for a period extending over three days or more, the study will be complicated by the growth in the water of several kinds of spirillum, which are apt to colonize around the edges of all diatoms. When this is the case, it may so happen that when a large Navicula is being closly studied in the field in expecting to detect some characteristic of motion, the mind will suddenly be

attracted by lightning-like flashes of little specks with
spiral and vibrating movements that dart from the ends
and sides of the moving diatom.   The illusion at first
takes the form of an idea that the diatom is discharg-
ing nettle-like threads, and as quickly retracting them.
Should the mind get caught under this spell once, it will
be a material duration of time before the observer, fascin-
ated by this illusory appearance, can dissociate his mind
from the idea that what is seen is not a part of the vital
function of the ectoderm of the diatom, and properly re-
fer this action to the parasitic colonies of Spirilla, which
seem to be living in symbiosis with their host the Navi-
cula.

How to Make and Stock a Fresh-water Aquarium.
BY REGINALD A. R. BENNETT, M. A. (OXON).

CONSTRUCTION OF THE TANK ITSELF.

When I saw the above announced as one of the sub-
jects for the forth-coming competitions, I at once made
up my mind to send in a series, and hope for the prize,
for the "E. M." has been an old friend to me for many a
long year, and I have all the back volumes from the very
beginning arranged on my bookshelf. I cannot truly
say that I took it in from the beginning, the first num-
bers having been presented to me some years after-
wards; but, no doubt, I should have taken it when it first
came out had it not been for the fact that the first num-
bers appeared during the same year that I myself burst
upon this lower sphere, and at that time I was more in-
terested in the maternal lacteal fluid than even in the
advance of science. However, later volumes have been
of invaluable service to me, and this is by no means the
first time that I have written in "Ours," though not be-
fore in the form of an article.

As I see that there has been some discussion as to the

capabilities of the winners of these prizes, I will here
state that I am writing this series from a personal ex-
perience with the matter, having myself practically kept
fresh water (and I may add, also marine) aquaria for a
good many years. The system and details of working
laid down are, therefore, the result of practical knowl-
edge.

I do not think it is necessary, in the pages of this
journal, to enter very deeply into the science involved in
the maintaining of an aquarium. Most of its readers are,
doubtless, aware of the compensating action of the vari-
ous animal and vegetable organisms, whereby the bal-
ance of life is kept up, and the fishes, etc., supply car-
bonic-acid gas which the plants, if in good health, util-
ize in the formation of their tissues, transforming it into
pure oxygen, which being dissolved by the water, is
taken up by the fishes and other animal organisms to be
utilized in the aeration of their blood. From a consid-
eration of these facts, it naturally follows that in our
aquarium we must have a supply of healthy plants to
manufacture the oxygen required, if the fishes are to be
kept for a long time in a satisfactory state of prosperity.
Given the suitable conditions, and it is perfectly possible
to keep the aquarium for many years without changing
the water, or moving animals or weeds. In practice I
have done this myself, though if the aquarium keeper
has a sufficiency of time on his hands, I think an occa-
sional turning out and cleaning is more likely to produce
a pleasing effect on the eye than leaving the tank to it-
self for the longest possible time. A great deal, how-
ever, depends upon the amount of water employed.

In setting up the aquarium, the first thing must neces-
sarily be the manufacture of the tank itself. And here
we are confronted by the question of the most suitable
dimensions. I do not think, in the case of a fresh water-
tank, the depth is a matter of very great importance,

as it certainly is in the case of a salt-water one. The amount of water it is to hold must, of course, settle its actual size; but, as a rule, it should be said that no tank should be deeper than it is wide, and its length should be about twice as long as its width. To descend to particulars : to hold 12 gallons the tank may be about 27 in. by 16 in. by 14 in. deep. One to hold up to 20 gallons will be about 36 in. long by 22 in. broad by 18 in. deep.

As to the actual structure of the tank, this, of course, depends very much upon the taste of the maker. Personally, I think the plainer the tank is (within limits) the better. It is the fishes and plants, etc., that are the objects of attraction—not a gorgeously ornamented tank. For this reason I look upon all ornamental "tops," brass fringes, etc., round the edges, and carved images on the pillars, etc., as abominations. If the tank is to have a top it can be composed of two perfectly plain pieces of glass, each the width of the tank frame and rather less than half its length, thus leaving a little strip between them when they are placed in position, through which the air can get at the water. If the beetles, etc., show a disposition to get out the vacancy can afterwards be covered with a strip of perforated zinc. The glass is, of course, held in its place by fitting into a rabbet in the upper surface of the frame, in which it can lie.

The following will, I hope, be sufficiently explicit directions as to the actual manufacture of the tank for those who have never constructed anything similar before. The first thing to do is to make the bottom. For this I have tried plain wood, wood painted and varnished, and wood covered with glass and cement, and am decidedly of opinion that wood in any form is to be avoided. The best thing to use is a tolerably thick slab of *slate*, and taking my first dimensions of the tank as an example, I think for this the slab ought to measure about 29 in. by 18 in. by 2 in. thick. This allows of a width of an inch

all round, which is advisable, though not esssential.   In
this slate, at a distance of about an inch from the edge
all round, you have to make grooves with holes at the ends
for the bottoms of the pillars, see Fig. 1.   These holes
should be about 1 in. in depth and the same in breadth ;
the grooves should be about ⅜ in. broad and *at least* 1 in.
deep.   You now have to construct the pillars, which are
made of hard birch wood—or mahogany will do—and
are shaped as Fig. 2.   The sides are, in my opinion, best
square, but you can make them round if you prefer it.
If square, the sides may measure 2 in. in breadth ; if
round, they ought to be at least 2¼ in. in diameter.   The
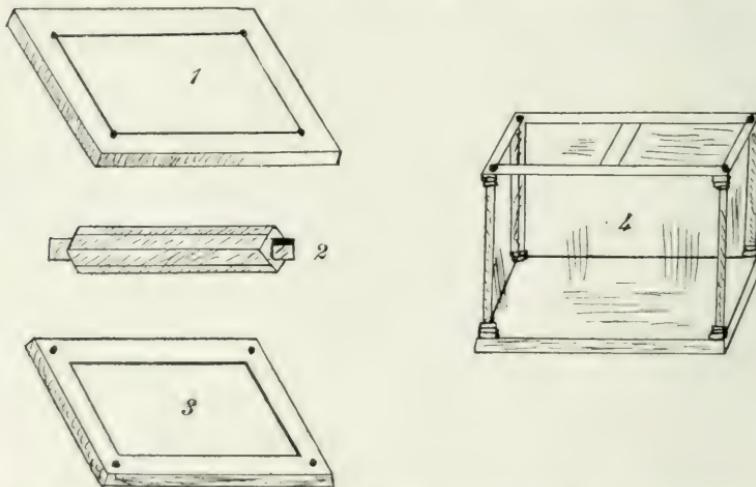
ends are, of course, to be cut to a circle about 1 in. in
diameter, or, better, shaped to accurately fit the holes
made in the slate bottom.   The part thus shaped will,
therefore, be about 1 in. long, while the middle (square)
part will be about 14 in. long.   Down the middle of the
pillars, on two sides, at right angles, are to be cut grooves
about ⅜ in. broad and *at least* ¾ in. in depth.   Some may
think my measurements unnecessarily large, but I have
suffered so severely in bygone years from aquaria which
leaked that I am quite resolved that if my measurements

are followed the English Mechanic tank shall, at any
rate, be water-tight. To secure this desirable end, we
have to fasten the pillars in their places with cement, and
on this cement a great deal depends. It has to be elastic
to a certain degree, so as to allow for changes of temper-
ature and the consequent expansion and contraction of
the glass and wood, it has to firmly resist the passage of
the water, and it has to be one that will harden in a fairly
short time, and that will not smell objectionable, as the
living inhabitants of the tank are particularly susceptible
to any foulness of the water caused by smells. The two
best cements that I know of for the purpose, and which
fairly fulfil the conditions required of them, are the fol-
lowing :—

Mix together one pint each of litharge, plaster of Paris,
pure white sand, and two-thirds of a pint of freshly
powered resin. These are thoroughly incorporated to-
gether by turning them over and rubbing them into one
another with the hands, and the mixture is then made
into paste with boiled oil and a little driers. It should
be of sufficient consistency to dry pretty quickly, but not
so stiff but that it will get into the holes and corners
easily. If properly made this will not take long to dry;
but you must leave the tank for a week at least, or more,
before you attempt to stock it; and when you do so you
must be quite sure, firstly, that the cement is really hard,
and, secondly, that the smell has entirely departed. The
second cement is made by melting in an iron ladle over
a gas flame or lamp three-parts of pitch and one of gutta-
percha. When they are throughly melted and incorpor-
ated together, apply liquid, and leave to set. This will
not take so long as the other to dry, but it must be left
till the smell has departed. It is impossible to lay too
great stress on this matter. To use the tank too soon is
not merely to court defeat, but to positively insure it.
If the lead cement is used, it is advisable to cover it with

two or three coats of varnish, made by dissolving sealing-
wax in methylated spirits of wine. When the pillars are
fixed in their places, you can proceed to insert the glass.
This is what is commonly called "32in." sheet glass, and
is cut to exactly fit the grooves. The panes are firmly
bedded in with the cement, and a light frame work is fit-
ted on the top to hold all together. This framework is
shown in Fig. 3. It is merely a frame about 1½ in. in
width and one-half inch in thickness. The top of each
pillar, above the square part, is cut to this length and in-
serted in the holes at the corner, and small knobs are in-
serted at the corners to give the tank an ornamental ap-
pearance. If a glass top is wished for, the frame is cut
with a rabbet about ½ in. wide all round on its upper
surface to receive the edges of the glass. The final ap-
pearance of the tank is shown in Fig. 4.

If the tank *has* to stand in a very sunny situation, I
think it is decidedly advisable to provide some means or
other of keeping out the superfluous light, as it acts
most injuriously on the creature in it; and causes such a
growth of confervæ on the sides that it is a continual nui-
sance to keep them clean. For this purpose I have al-
ways considered it best to have light shutters of thin
wood constructed which will just go inside the frame
formed by the bottom, top frame, and pillars, and outside
the glass. This is done so easily that it requires no fur-
ther description. I think this plan is desirable, because
it allows of the complete closing of the sides of the tank
in summer, when the weather is warm, and allows the
shutters to be removed when it is desired to see any ob-
ject close to the glass, or when the weather is cold during
the winter. It is, therefore, much to be preferred to
making the sides or ends permanently of slate.

In this series there is not space to describe further de-
velopments of the construction of the tank. It is also
unnecessary, for any one, given the above details, can

easily construct any other form which his fancy may devise, or in combination with window conservatories, etc., by the use of a little brains. If the simple form of tank is used you will require a stand for it. This may have a top of its own, or the bottom of the tank may form the top. Anyhow, it is hardly necessary to say that it must, before all things, be firm and steady, as a collapse would be about as unpleasant a reverse of fortune as could befall the tyro aquarium keeper. It is preferable to use a table or stand with side bars between the legs about half way down.

When you are perfectly satisfied that the tank is quite dry, the cement hard, and that no smell is issuing from it, you can proceed to stock it, the method of which will be considered in the next chapter. But before placing anything in it, it should be most thoroughly cleansed by washing, and then rinsed with fresh water. After this, it must undergo a further process of purification by filling it with fresh water every few hours at first and letting it soak, then fresh water at intervals of a day, until the water is perfectly free from any smell, and especially from any prismatic scum on the surface, which is a sure indication of danger.—*English Mechanic.*

We learn from the French newspapers that M. Etienne will shortly introduce in the Chamber of Deputies a bill introducing the decimal subdivison of time.

Mr. C. G. Pringle has just returned from another botanical journey in Mexico, where, during the past season, he has secured about 20,000 herbarium specimens in the valley of Mexico and in Cuernavaca.

On account of his important work on Blood Test for cattle tuberculois, which has been published in many scientific papers at home and abroad, Dr. Ephraim Cutter, LL. D., has been invited to go to Africa to study the cattle Rinderpest, under the English government.

Surgical Sterilization and Sterilizers in Private Practice.

By EDWARD BOECKMANN. M. D.,

ST. PAUL, MINN.

Last May I delivered an address in Buffalo, N. Y., before the Association of Military surgeons of the United States, on "Asepsis in Military Service." This address, printed in the transactions of that society, considers at length the principles of sterilization, and gives at the same time a number of practical points just as applicable in operations in private practice as in operations in military service, for which reason I take the liberty to refer you to that for details.

With regard to the mechanical and chemic phases of surgical sterilization I have not much to add to or take from what I said last year. Supported by further experience, I can this year more strongly than last recommend the 1 to 2 per cent solutions of lysol at 120 degrees F. for combined mechanical and chemic disinfection of the operator's hands and the patient's skin.

Lysol possesses the undeniable advantage of being at the same time antiseptic and aseptic; it is a happy combination of a powerful disinfectant and soap (saponified cresol). It has the dissolving and penetrating properties of an alkaline substance. I know of no agent which at the present time is better adapted and more reliable in the disinfection of the skin than lysol, with the possible exception of alcohol, which certainly, with good reasons, receives the support of the world. Heretofore we have viewed alcohol in the light of a purely mechanical agent in the disinfection of the skin; this can no longer be successfully maintained. Alcohol is certainly a potent solvent of a great number of substances, sparingly, however, of fats. Alcohol must be viewed as a strong antiseptic, possessing the same significance for the skin as for anatomic preparations, taking up its moisture, pene-

trating and hardening them; a decided advantage over ether and turpentine, which certainly dissolve fat much more readily, but which are much less hydrophile. In order to obtain the greatest possible antiseptic effects of alcohol it is obvious that the skin must be dried, and strong, preferably absolute alcohol used, and the skin energetically rubbed for some little time. Since experience has taugh me that the germicidal principle in lysol acts as a powerful antiseptic in the above mentioned strength, and as a prolonged friction with absolute alcohol makes my skin uncomfortably hard and brittle, I reserve the alcohol for the field of operation only.

The last act in my sterilization of the skin consists in impregnating it with sterilized lanolin. By this procedure it is my intention to restore to the integument its fatty protective, which has been removed to the greatest possible extent by the preceding chemico-mechanical disinfection; at the same time I aim to cover up the remaining, inaccessible bacteria. Lanolin, which is rich in bacteria, is sterilized simply by heating the anhydrous article over the fire in an enameled vessel to about 350 degrees F., whereupon it is either run into collapsible tubes (sterilized in boiling water), or mixed with four to five parts of anhydrous ether, as soon as it has cooled below the boiling point of the latter, and then put into patent stoppered, sterilized glass bottles. Lanolin contains a great many impurities not soluble in ether, and which sink to the bottom as a voluminous, white sediment; only the clear, yellow solution is used.

Provided with lysol, absolute alcohol and ethereal solution of sterilized lanolin, we are enabled to disinfect the skin, the most dreaded bearer of infection, as safely I imagine, as is possible at this time; and with as few and simple agents as can be demanded in operations in private practice.

While I practically occupy the same standpoint with

regard to chemico-mechanical disinfection, I must take
up the thread where I dropped it last year, as far as
thermic disinfection is concerned. It is quite natural
that surgeons who occupy themselves with operations in
private practice, not only are interested in portable
sterilizers, but also prefer such as are constructed for
combined boiling in water and its steam.   Inventive gen-
iuses have also from time to time, at short intervals, en-
deavored to satisfy this popular demand, but they have
all, as far as I know, up to the present committed the
error of constructing their apparatus for under-steam,
which streams through the sterilizing chamber from be-
low upwards; that is, a stream, which neither expels the
air, nor penetrates the articles to perfection, and which
consequently results in deficient condensation, besides
leaving the articles moist. All sterilizers for streaming
steam must necessarily be constructed for over-steam;
the reasons being fully given in my article previously
referred to. Personally I am not particularly in favor
of combination sterilizers even when scientifically con-
structed, chiefly because boiling and steaming are differ-
ent processes requiring an unequal time, steaming at
least three times as long as boiling, not to speak of the
time required to dry the dressings after sterilization.
This entails the practical disadvantage, that instruments,
for which boiling is our method of choice, suffer unneces-
sarily in the prolonged boiling, but, as this can be
avoided, as I will explain shortly, I have in deference to
the apparent popular demand revived the idea of a com-
bination apparatus, which I described in the *Medical
Record* a couple of years ago, and it is my improvement
upon that apparatus which I take the liberty to demon-
strate upon this occasion.

My combination portable sterilizer consists, as you see,
of four parts: 1, the boiling plan; 2, the hood; 3, the in-
strument tray, and 4, the steam chamber.

The boiling pan is made oval for the sake of the instruments; convenient dimensions being four to five inches high, eight inches wide and sixteen inches long. Around the upper border on its outside is constructed a groove half an inch deep. The center of the bottom is perforated by a small opening, into which is fastened a tube, which extends to the level of the upper border of the pan;

under the opening at the bottom is placed the iron plate, familiar from my other sterilizers.

The hood, which fits closely within the outer lip of the groove of the boiling pan described above, and whose height is adjusted to that of the steam chamber, above which it extends half an inch, has a sloping roof, whose extreme top is perforated and fitted with a short tube or chimney. The hood is supplied with handles, and can be fastened to the boiling pan by means of two hooks.

The instrument tray is made to fit accurately within the boiling pan, the corners are cut off to allow for the legs of the steam chamber, the bottom is of galvanized wire and the frame is provided with two handles.

The steam chamber is of the same form and dimensions as the boiling pan; the chamber extends downward in a

sloping bottom, whose lowest, perforated point is on a
level with the upper border of the pan; into this opening
is fastened a tube, which fits accurately outside that
described in the boiling pan and which is of the same
length; at the juncture of the steam chamber and its slop-
ing bottom is placed a diaphragm of galvanized iron; be-
tween this and the opening beneath is a small square tin
plate; the chamber rests upon four legs, is provided with
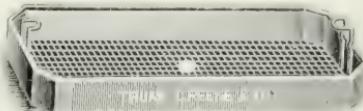
handles and a sloping cover, perforated at the top under-
neath a handle.

Directions for use.—The boiling pan is filled with a
sufficient quantity of water, care being taken to fill the
groove at the same time; the hood is adjusted, and the
whole placed over any good fire. While the water is
heating, the instruments are arranged on the tray, and
the dressing, etc., (previously washed) in the steam cham-
ber; needles, drainage tubes, ligating and suturing
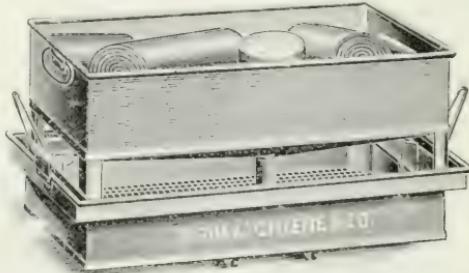
materials are put separately in a small metal box (sterile
catgut is brought along in hermetically sealed envelopes).
When the water boils, the hood is removed, the steam
chamber put in, whereupon the hood is replaced with a
cork in the upper tube. The steam will now ascend be-
tween the hood and the steam chamber to the top; the
cork at the top and the water in the groove and in the

pan acting as locks, the steam is forced to work its way through the opening in the cover of the steam chamber into this, through the articles contained, and out through the tube in the boiling pan. In the course of a quarter of an hour the sterilization is completed; the hood is removed, also the steam chamber; the instument tray is now put in, the steam chamber is replaced, the hood likewise, *but without its cork*. For the preservation of the instruments a little soda or soap has been added (lysol serves the same purpose.) In the course of five minutes the instruments are surgically sterile; during this time the steam will escape continuously through the open tube

of the hood, both that delivered by the water and that contained in the steam chamber; simultaneously a draught of hot air will enter the chamber from below, and when this is removed, its contents are not only sterilized, but also dry. A combined sterilizer of the dimensions above mentioned can, without difficulty, be transported in a suitable wooden case, and as the preparation and sterilization of the necessaries is an easy matter, there is no possible excuse for resorting to mercantile antiseptic goods in operations in private practice. The surgeon who relies indiscriminately upon antiseptic wares, which he buys, is a dangerous man!

Articles adapted to sterilization by steam can safely

be transported to the place of operation in various ways, Bloch's method in double filtering paper being preferable; it is, however: always safer to sterilize on the spot, and, as only half an hour is required for the whole procedure, it is also practicable. In urgent emergency cases a surgeon ought never to be taken by surprise, and as time is valuable in such cases, he should always have on hand a supply of sterilized articles.

One more remark with regard to operations in private practice. I will most emphatically impress upon all surgeons, with the possible exception of those few who are masters both in surgical technique and in asepsis, to consider every wound at the end of an operation of some duration slightly infected, and therefore to combine their asepsis with a judical antisepsis. Thus I am in the habit of repeatedly dipping my hands during the operation in a weak, sterile solution of lysol ($\frac{1}{2}$ per cent or even less). The small amount of antiseptic which in this way is carried into the wound, I have yet failed to find objectionable, and I use lysol because it is at hand, and because it is alkaline like the fluids of the tissues. And when the operation is completed, I apply next to the wound an antiseptic dressing, not exactly the customary iodoform gauze, because its preparation requires extraordinary facilities, but antiseptic, and at the same time aseptic, hydrophile ointments. Anhydrous lanolin absorbs moisture greedily; it is first sterilized, mixed while cooling with 2 per cent lysol and run into tubes. A generous quantity is expressed over the wound, and over this the ordinary dressing is applied. Changing this dressing is unattended by the disturbance of the wound or the patient's comfort, as it does not stick like a dry dressing.

In the foregoing it has been my aim to dwell upon the most essential points in surgical sterilization and sterilizers in private practice, points which I could stamp with some degree of originality.—Journal Am. Med. Assoc.

The Preparation of Diphtheria Antitoxic Serum.

By H. K. MULFORD, Ph. G.,

PHILADELPHIA, PA.

The discovery of diphtheria antitoxin was made by Behring as result of his primary and original investigation in connection with Kitasato upon tetanus antitoxin.

The method of preparation first proposed was the injection into suitable animals of cultures of the diphtheria bacilli in which the bacilli had been killed by heat. When the animal could withstand such injection, manifesting only a slight irritation or œdema at site of injection, or showing but feeble temperature reaction, highly attenuated living cultures were introduced in increasing amounts, a sufficient immunization or resistance being given by the primary injections to prevent fatal termination. The injection of living cultures, however, is greatly to be discouraged, since such injection and those of attenuated cultures containing dead bacilli are accompanied by great destruction of cellular tissue of the animal which is to furnish the antitoxin, its physical strength being lessened by such destructive processes.

The best method is as follows: As virulent a culture as possible of the *bacillus diphtheriœ* is obtained. It is grown upon Loeffler's solidified blood serum mixture and placed in an incubator at a temperature of 45 degrees C.

After a period of 24 hours the cultures are developed. From this a single culture or colony of the bacilli is transferred into small flasks of a 2 per cent peptone bouillon rendered decisively alkaline to litmus. These small flasks are placed in an incubator which is kept at a constant temperature of about 37 degrees C. for 24 to 48 hours, and afterward the contents are transferred with peptone bouillon into rounded flat flasks with a long neck (so that sterilized cotton may be pushed well into the tubulature) of a capacity of 500 ccm. These large flasks are placed

in the incubator and kept at a constant temperature of 37 degrees C. until the bacilli have become very numerous, and have secreted enormous amounts of active and powerful toxin in the bouillon.

When this has taken place a microscopical examination is made to see that bacilli other than the Klebs-Loeffler are not present, and the diphtheria toxin thus contaminated. If uncontaminated 1 per cent of trikresol is added to prevent contamination and to destroy the *bacillus diphtheriæ*. The bouillon, or, as we now term it, diphtheria toxin, is filtered through a modified Chamberland filter to separate from it the dead bodies of the diphtheria bacilli. No bacilli are therefore injected into the animals to be immunized, and they are not given diphtheria, but only the toxin secreted by the bacilli.

DETERMINING THE TOXICITY OF THE TOXIN.

The toxicity of the toxin is determined by its injection into guinea pigs. To be of the desired strength, 0.01 to 0.1 ccm. should produce death of the control animal in from 24 to 36 hours.

For the preparation of diphtheria antitoxin any animal may be selected, but horses are preferred, inasmuch as they are more easily operated upon, and because they furnish excellent serum in liberal amounts. Our experience as to the type of horses selected, particularly in the earlier observations, have been valuable, the majority being of unusually high quality, a number showing trace of fine breeding; such horses, however, are not suited for immunization. The finely bred horse being sensitive, frets at his inactivity (for no work is performed by the animal while being immunized, only a sufficient amount of exercise being given to maintain good health), neither does he take kindly to the injection of the toxin or the subsequent bleeding operations. The preference is given to large, compactly built animals, of dark color, 16 to 18

hands high, from 1,400 to 1,600 pounds weight, of quiet disposition, and possessing good health.

TESTING FOR GLANDERS AND TUBERCULOSIS.

Before the injecting with toxin, the malleine test for glanders and the tuberculin test for tuberculosis is applied, the results of such being clearly shown by the temperature. Animals responding to either of these tests must be discarded.

The primary injection of the toxin is 1 ccm. At equal periods of from six to eight days, constantly increasing amounts of the toxin are administered until in about ten weeks to three months as great quantities as 300 ccm. of this powerful toxin may be borne with tolerance.

When the injection of these larger amounts is accompanied with but little elevation of temperature, and but a slight œdema is manifested at site of injection, a trial bleeding is made, 20 ccm. of blood being taken from the jugular. If the tests for antitoxic value, as described later under the testing of antitoxin, are favorable, the horse is bled, the blood being collected in sterile bottles, and placed in a refrigerating room for a sufficient time (about 24 hours) until the fibrin coagulates, allowing the serum which contains the antitoxin to remain clear. This serum is drawn off by pipettes and preserved by the addition of 0.5 per cent trikresol.

The most important step now awaits the operator, the determination of the exact strength possessed by the antitoxin as expressed in immunizing units.

THE IMMUNIZING UNIT.

Immunizing units represent the strength of antitoxic serum that is required to save a guinea pig from ten times the absolute minimum fatal dose of the diphtheria toxin, and the strength of the antitoxin is designated by the number of immunizing units per ccm. of the serum.

For this purpose the minimum fatal dose of the toxin is

accurately determined by injections of various amounts
of toxin into a number of guinea pigs, the smallest
amount of toxin that invariably causes the death of the
control animal in a reasonable time being regarded as the
minimum fatal dose. It is usually calculated so much
per 100 gm. body weight.

Every lot of antitoxin is carefully tested, and if the control animal shows evidences of œdema at site of injection,
or diminution in body weight, the antitoxin is rejected.

A page from the laboratory minutes shows this determination of strength. Having found the minimum fatal
dose here used to be 0.005 per gram weight of guinea pig,
the control animals are given ten times this absolutely
fatal dose of diphtheria toxin or poison, and if testing
for 100 units per ccm., as appears from experiment on
animal No. 1,080, 1-1000 ccm. antitoxin obtained from
horse No. 109 H is given; if testing for 250 units per
ccm., 1-2500 ccm. of antitoxin is given; if for 500 units,
1-5000 ccm. of antitoxin would be administered.

Tests for 500 units are shown on control animal 1,070
and for 350 units on control animal 1,076.

While this paper does not deal with the therapeutic
value of diphtheria antitoxin, the absolute scientific value
and correctness of these tests may be appreciated by
these observations, and we prove the therapeutic application of the antitoxin by its neutralizing or protective
value upon the control animals receiving ten times the
amount of toxin that always kills. Unfortunately, we
cannot thus arrive at the dose for therapeutic application
since the human subject is much more susceptible to the
poison, and we have no possible means of determining
the amount of toxin secreted by the diphtheria bacilli in
the patient suffering with diphtheria.

Appreciating, however, that the only effect of diphtheria antitoxin is in neutralizing the toxins of diphtheria,
we know how necessary it is to make application of this

"healing serum" before the nerve centers become paralyzed, the heart and kidneys become diseased and the entire system invaded by the absorption of the fatal toxin.

THE PRESERVATION OF ANTITOXIN.

Diphtheria antitoxin is a most delicate substance, and its preparation can only be safely carried on in thoroughly equipped institutions where men of undoubted integrity of purpose and ability are in supervision.

While antitoxin is a delicate substance, yet, when a proper preservative in a sufficient amount is used, and it is hermetically sealed in sterile vials, it will preserve its strength and antitoxic value for at least six months; indeed, repeated experiments prove it retains its activity for a much longer period.

Chloroform, camphor, sodium salicylate, carbolic acid, and formaldehyde have been employed, but the preference is greatly in favor of trikresol and formaldehyde. Camphor seems to be particularly dangerous, since it possesses but a feeble preservative action, and its strong odor will prevent the detection of putrefactive processes should they be established; chloroform and sodium salicylate are unsuited on account of their active therapeutic effect.

Trikresol in a strength of but 0.5 per cent protects the serum absolutely; in fact, pathogenic bacteria do not develop with this percentage of trikresol; it is not a poison, as is carbolic acid, nor is it an irritant to the urethral tract. A disadvantage is that it produces a semi-fluorescent appearance in the serum, but the absence of cloudiness is shown by permitting the light to enter squarely through the vials containing the finished product.

STRENGTH OF SERUM.

Antitoxin is usually supplied in bottles containing varying quantities of serum, but of a certain number of antitoxic immunizing units. This is apt to lead to confusion,

and we would strongly recommend that a fixed standard of a definite number of immunizing units be secured in each ccm. of serum. While this involves extra labor, it prevents confusion on the part of the physician, and the end is well worthy of the increased labor. If serum is produced of a strength of 125 units per ccm., it may be mixed with an equal amount of serum containing 75 units per ccm.; the result is that each ccm. will contain 100 immunizing units, and if 500 units are desired to be administered, 5 ccm. will be understood as the requisite amount to be injected, etc.

HIGH POTENCY SERUM.

It is a matter of gratifying interest to Americans that serums of the highest antitoxic values have been prepared in our country. Serums are now produced of which each ccm. contains as much as 800 units, and we confidently believe that as much as 1,000 antitoxic units to the ccm. will be produced in the near future. This overcomes the chief objection that has been urged against the serum even by its warmest advocates. More prompt absorption will take place, insuring quicker results, besides the attendant dread caused by the large instruments necessary for the introduction of larger amounts of weaker serum will be avoided, as much as 2,000 units being administered in an ordinary two ccm. or 30 minim syringe.

DRIED SERUMS.

Dried serums are much less active than fluid or fresh ones. They are prepared by addition of aluminum or ammonium sulphate, with subsequent precipitation of the antitoxin by a 1 per cent soda solution or by inpissation. They have given fairly good results, but cause greater irritation than do the fluid serums, and not being freely soluble, cause annoyance in administration and give greater opportunities for contamination in their preparation and dilution for administration.

HOW ANTITOXIN ACTS.

We do not know what action takes place in the serum of the horse producing the antitoxin, nor do we know positively its action upon the organism of the control animal or the patient treated for diphtheria. The fact that the control animals always recover under the influence of antitoxin, while they always die with but one tenth the amount of toxin, and the reduction in mortality of patients ill with diphtheria under the influence of antitoxin, are, however, self-convincing. No reason can exist for its non-employment on this ground, since we do not know the nature of the changes from pepsin to peptones, albumen to albuminoids; the action of arsenic in anæmia, mercury in syphilis, and many of our therapeutic agents. They are used empirically because favorable results are secured.

The accepted theory of the action of antitoxin is that it renders the living cells of the organism tolerant to the toxin liberated by the diphtheria bacilli and by increasing this tolerance they are able to overcome these toxins.

That antitoxin exerts no chemical action on the toxin can be proved by mixing toxins and antitoxins, and maintaining the mixture at a temperature of 70 degrees C. for some time. At this temperature the antitoxin is destroyed, while the toxin remains but slightly disturbed in virulence.

Ewing and Billings have made numerous experiments as to the action of antitoxic serum upon the blood, and agree that: "In cases of diphtheria treated with antitoxin the diminution in the number of the red corpuscles it much less marked than in those cases treated without it. The leucocytes are apparently unaffected in number by the antitoxin, the hæmoglobin is also much less affected in the cases treated with antitoxin, thus confirming the statement as to the red corpuscles, while the leucocytes are stimulated in action, as evinced by taking more vivid color when stained with indigo solution."—*Am. Druggist.*

EDITORIAL.

The Cochineal Insect.—The cochineal insect is a native of Mexico, where it was raised by the Mexican Indians long before the country was discovered by the Spaniards. It is now cultivated in the West India Islands and in some of the Southern States but only in Mexico does it form an article of commerce.

The insect is raised on the cochineal tree, or nopal, which is a species of cactus. It grows freely from cuttings, and these are fit to receive insects after eighteen months. Into a nest formed of a thread-like substance or of cottony matter, a few females are placed about the first of October. The nests are fastened to the side of the tree facing the rising sun, and eggs are soon layed. As each female produces upwards of a thousand eggs, a large colony is formed. Six generations are produced in a single year.

On first leaving the egg the insects are quite lively and run about over the tree. They are so small as to require a magnifying glass to see them. They are flat, ovular, without wings and with short antennæ or horns. The females have a small, short, almost conical beak, placed between the first and second pair of feet, which contains a sucker. It is by means of this sucker that they draw forth the juices of leaves and tender stems.

When the insect has reached the perfect state, it is filled with a multitude of minute eggs. These she lays, then dies, her body becoming a covering for the eggs until they are hatched. When this is done the insects work their way out and commence feeding. After a short time their skins harden and serve as a cocoon. From this they pass into a chrysalis state, and soon after appear as the perfect insect.

The cochineal is collected about the first of December. The insects are removed from the trees with a knife or squirrel tail. They are then dried by heat or in the sun. When the cochineal arrives in the market it is in the form

of a small grain, concave on one side and convex on the
other, having a little resemblance to the body of an insect.
It colors purple naturally but when mixed with nitro-
muriatic acid gives a beautiful scarlet.

New deposits of Infusorial Earth found in Europe.
—Some large deposits of kieselguhr (infusoral earth) have
been discovered at Kissatib, near Achalzich, in the Cau-
casus. It occurs in strata which altogether are about 40ft.
in thickness. Some of the strata are of a snowy white,
while others are beautifully striped in various ways by
layers of oxide of iron, etc., thus resembling marble.
Efforts are being made to find a process for hardening this
material, for its variety of beautiful designs combined with
extreme lightness would make it a precious stone for
architectural purposes. White kieselguhr is used for a
variety of purposes, as in the manufacture of dynamite,
colours (ultramarine), matches, for isolating purposes, etc.
The Kissatib, kieselguhr is remarkable for its purify (3
percent of sand) and whiteness.

MICROSCOPICAL APPARATUS.

The Microscope in Pharmacy.—The pharmacist of to-
day finds considerable use for the microscope; the phar-
macist of to-morrow will find it an indispensable accessory
in his business. Already a limited knowledge of the use
of the instrument is required in the examination room,
and as time passes the requirements in this direction are
likely to be greatly extended. Accordingly, it seems de-
sirable to point out that the microscopical examination of
substances is simply an essential step in the complete vis-
ual examination of those substances. Everyone realises
that the nearer, within certain limits, an object is brought
to the normal eye, the larger it appears and the more dis-
tinctly its details are apparent. When brought within a
distance of two or three inches, however, the image be-
comes blurred and indistinct, whilst an object held close
to the eye cannot be seen at all, and simply obstructs light,

Now the use of a hand lens enables one to bring an object under examination much closer to the eye than is normally possible, for the outer surface of the lens represents that of the eye for the time being. As a result the object appears much larger, and more structural detail is revealed than when the object is viewed by the unassisted eye. Similarly, the compound microscope still further lessens the distance between the object and the eye, the surface of which is now represented by the front of the objective, and to speak of the image of an object as being enormously magnified under the microscope is simply another way of expressing the fact that the object has virtually been brought into such close proximity to the organ of sight as is normally impossible. Examination of an object by the aid of the microscope, therefore, must be regarded as a mere extension of the limits within which the normal human eye is capable of clearly distinguishing the details of objects. As spectacles help the partially blind to see, so the microscope enables those with perfect eyes to see more than is possible without such aid, and the natural conclusion is that pharmacists and others whose skill is partly dependent upon the accurate impressions they form of the appearance of objects, should be adepts in the use of an instrument that can so increase their natural powers.—Pharmaceutical Journal.

MICROSCOPICAL MANIPULATION.

Preservation of Microscopic Specimens. Dr. Jores describes a method, which he has tested for a year and a half of preserving organs and tissues so that they retain the color they had when fresh. He finds that five to ten parts of a fifty per cent solution of formalin alone causes the organs to assume a tint which varies considerably from the natural color. But instead of using water to dilute the common formalin solution, he uses one part common salt, two parts of Magnesium sulphate, two parts sodium sulphate in one hundred parts of water. This preserves the color of the blood.

Further, material preserved in such a solution is better adapted for subsequent microscopic examination, since the protoplasm of the cell is less altered and the nucleus stained better and deeply.

The method he adopts is as follows:—The material must not be too long washed in water, and should be left in the formalin for a period depending on size and thickness. A kidney or spleen requires two days' immersion and the solution should be changed until it no longer gives a dirty brownish red color. Care must be taken to bring all portions of the object into contact with the solution, and the object must be given the color it is to retain permanently, since the formalin solution causes it to assume a consistency such that its shape cannot afterwards be modified. In the formalin solution the organs change color and become of a dirty bluish grey. On placing them in ninety-five per cent alcohol the normal color returns. Before permanently placing the organ in alcohol it must be washed in alcohol until the latter no longer becomes cloudy. The material must not be washed with water; it is left in alcohol until the normal color returns; if left longer the alcohol removes the color. For a kidney or spleen, twenty-four hours will be sufficient. The permanent preserving fluid is equal parts glycerine and water; the material floats at first but sinks later; the color is now at its best, after a little while the fluid becomes yellowish and wants renewal. Tissues so preserved have not undergone the slightest alteration in nine months.

The method is not applicable to other color than blood.— Int. Med. Magazine.

Infiltrating Dental and Osseous Tissues for Microscopical Work.—At a recent meeting of the Odontological Society of Great Britain Mr. Charters White gave the details of the method he adopts to demonstrate the presence of spaces in hard sections of dental and osseous tissues. The section to be treated must be ground moderately thin, to about 1–32 in , and then immersed in absolute alcohol for five minutes, and subsequently in ether for a similar period. It is next transferred to a thin solution of celloidin

(three grains of celloidin to half an ounce of equal parts of absolute alcohol and ether). This solution is colored red by the addition of fuchsine, the stain being added to the alcohol before the celloidin is dissolved. The specimen is allowed to remain in the solution for two or three days, after which it is removed and placed on paper to dry. The section is then ground to the desired tenuity and mounted on balsam. The advantages of the process are (1) the cavernous and tubular structures in dentine and bone are filled with a colored medium, which prevents the balsam from running into such spaces and so obliterating them ; and (2) the section is rendered less brittle and can, therefore, be easily ground down without much fear of fracture.—English Mechanic.

BIOLOGICAL NOTES.

An international botanical garden is to be established at Palermo, under the direction of Prof. Borzi, of the University. It is hoped that the favorable position of the garden may attract foreign students.

It seems certain now that the late Dr. Alfred Nobel has made a munificent bequest to science. According to the terms of his will, so it is said, a fund is to be formed from all his realisable property, the yearly interest from which is to be divided into five equal portions, the first of which is to be allotted as a prize for the most important discovery in the domain of physics; the second for the principal chemical discovery or improvement; the third for the chief discovery in physiology or medicine; the fourth for the most distinguished literary contribution in the same field ; and the fifth is to be allotted to whomsoever may have achieved the most or done the best to promote the cause of peace. All these prizes are open to the world. After deducting a few bequests to individuals, it is expected that the fund thus devised to the cause of progress will amount to the sum of nearly two millions sterling.— English Mechanic.

Mr. George J. Burch, of Oxford, England, has been experimenting upon plants with Rontgen photography. He finds that flower buds and seed vessels are especially favorable objects. He believes that if the photograph could be made upon a magnified scale the outline of every cell would be seen. The capsules of hyacinth and the flower buds of fuschia are reproduced in his account published in Gardeners' Chronicle III.

Numbers 11 and 12 of Lloyd's Photogravures of American Fungi have recently been distributed. They represent respectively Lepiota morgani Peck and Sparassis herbstii Peck, two interesting species. The first was photographed as it grew in the field, and makes an unusually attractive and characteristic picture.

BACTERIOLOGY.

Bacteriosis of Carnations.—Dr. J. C. Arthur and Prof. H. L. Bolley give an excellent account of one of the most serious difficulties the carnation grower has to encounter, namely, Bacteriosis which they ascribe to a new organism, Bacterium dianthi. The organism responsible for this disease is oval or elliptical in outline and does not occur in chains. It is motile and produces zoogloea. In gelatin it produces at first a smooth even growth along the track of the needle, having a pale cream color, later it assumes a marked appearance and the color is bright orange, being much deeper in acid cultures. It slowly liquefies gelatin. The zoogloea are formed as follows: "Certain individuals, without ceasing active multiplication, become non-motile, and at once begin to excrete a gelatinous envelope. This envelope offers considerable resistance to longitudinal extension, and the new cells as they form slip past one another, accumulating in an elongated mass, which increases faster in thickness than in length." If the nutrient material is not renewed, the zoogloea disintegrate in ten to fifteen days by liquefaction of the gelatinous envelope; this permits the bacteria to fall to the bottom of the fluid. They multiply very rapidly, a well marked constriction occurred

within seven minutes and in twenty minutes more there
were two full grown bacteria formed from each original
cell, although still attached to each other. At this rate of
multiplication 280,000,000,000 would be formed in twenty
four hours. They would occupy fully one inch of cubic
space. This organism is an aerobe and makes compara-
tively rapid growth at 8–10 degrees C. The rate of divi-
sion increases up to 34–36 degrees C, but above this point
it is less rapid. Some growth was obtained at 45 degrees C.
As to its parasitic nature, in its early stages the individual
bacteria are imbedded in protoplasm, the chlorophyll
grains become disorganized, the protoplasmic utricle is
broken up and the contents of cell are disintegrated. This
germ has the power of eroding the cell-wall and thus
dissolves for itself a passage way, which may be brought
about by an enzym and it is probable that the perforation in
the cell-wall is quickly healed by growth and swelling of
the same. They enter the host by means of stomata or
accidental punctures. It readily attacks young and partly
grown leaves. In addition to an account of the distribu-
tion of the disease and the varieties affected they treat the
economic aspect. The paper is accompanied by two ex-
cellent colored plates and six other plates which show the
character of the organisms. (Purdue University, Agrl.
Exp. Sta. Bull., No. 59, Vol. VII, March, 1896.)

Microbes that Make Glucose.—Everyone knows the
service-berry, that decorative shrub that retains its bright
red berries even in the middle of winter. Now these berries
were the subject of a sort of puzzle about half a century
ago. In 1852 Pelouze, examining the juice of service ber-
ries that had been left for a long time at the bottom of a
dish, discovered a perfectly crystallised substance, very
sugary, and having all the properties of glucose. He saw
nothing here that was not perfectly natural. We find
sugar everywhere, or almost everywhere; there was
therefore nothing astonishing in the discovery, and the
new sugar was christened *sorbine* or *sorbose*. But now
began the puzzle. When, a little later, other scientists de-

sired to prepare some sorbose directly, they could not get any. Byschl and Delffs could obtain it neither from the fresh nor the fermented juice. In short, the fantastic sorbose, born by chance in a laboratory retort, refused absolutely to make its appearance again. We know now why this was; the mystery has been brought to light by a chemist at the Museum—M. Bertrand. By crushing ripe service-berries and then exposing them to the open air M. Bertrand obtained first alcohol by ordinary fermentation, and soon a whitish layer covered the surface of the liquid; the alcohol disappeared in its turn, the layer grew mouldy, but in the remaining liquid it was proved that there was no trace of sorbose. He tried again and again, and one fine day on the layer of which we have spoken a fly alighted, a little red vinegar fly. Then all was changed. The membrane thickened, soon swarmed with larvæ, and in the liquid below it great quantities of sorbose appeared. This is what had taken place: the membrane was made thick and heavy by the thousands of microbes that had been brought by the little red fly, microbes whose oxidising inflence had rapidly transformed the juice of the service-berries into sorbose. The experiment, after that, could be repeated at will. Thus recognised at length, the industrious microbes, whose length is less than a thousandth of a milli-metre (.025 of an inch) require no urging to manufacture in a few hours nearly a kilogram (2lb.) of the new kind of glucose.—Cosmos.

The experiments made with nitrogen in this country do not seem to be conclusive (see p. 561, Aug. 7 last). An important paper on the subject has appeared in a German bacteriological journal, giving experiments showing the capability possessed by *Bacillus radiciola* of growing on foreign culture media. It will be remembered that Dr. Nobbe isolated some twenty of these nitrogen-assimilating bacteria from the root nodules of various leguminous plants, and has endowed them with the collective title of "Nitragin." In the present experiments bacteria from the lucerne nodules were cultivated in pure media derived res-

pectively from infusions of lucerne and from white mustard, their cultivation being carried on through several generations. On the lucerne gelatine the bacteria flourished abundantly up to the last; on the mustard gelatine they gradually faded away. It was tried if these lucerne-nodule-bacteria could be induced to thrive on the mustard medium by gradual training, and in the course of six months that was accomplished.—English Mechanic.

MEDICAL MICROSCOPY.

Test for Typhoid Fever.—William Trelease, Recording Secretary of the Academy sent to *Science* the following account of the meeting January 4, 1897: Dr. Amand Ravold gave a microscopic demonstration of Widal's test for typhoid fever, demonstrating that after the disease has existed for four days or more the blood of typhoid patients, probably because of some contained anti-toxine, possesses the power of inhibiting the motion of typhoid bacilli from a pure culture introduced into it within a period of one hour or less, whereas in normal blood similar bacilli retain their power of locomotion for an indefinite length of time. It was stated that typhoid blood possesses this property even after having been dried for a period of four weeks or more, so that a few drops obtained from a person suspected of having the disease may be sent to suitable places for applying the test, thus rendering comparatively easy the early diagnosis of a disease which in its early stages presents many clinical difficulties.

PERSONALS.

We learn through the newspapers that on December 26, the remains of Prof. Louis Pasteur, the eminent bacteriologist, who died September 28, 1895, were removed from the Cathedral of Norte-Dame to the Institute, where they were received by a gathering of distinguished men, including Premier Meline, MM. Rambaud and Brisson and sev-

eral well known men from Great Britian. President Faure
and Gen. Billot, the minister of war, were represented at
the ceremony. Speeches were made at the crypt of the in-
stitute by M. Rambaud, M. Bodin, president of the muni-
cipal council of Paris, Dr. Evans, Dr. Rice Duckworth and
others.

Dr. John B. Hamilton has resigned from the Marine
Hospital service.

Dr. Geo. H. Rohe, Secretary of the Rush Monument
Committee reports October 31, that since the last report
in April he has received the small sum of $159.00 making a
total of $3,886.39.

Dr. Hugo de Vries has been appointed director of the
botanical gardens at Amsterdam in the place of Dr. Oude-
mans.

Dr. J. de Winter, assistant in the Zoological garden at
Antwerp, has been made director of the Zoological garden
at Giseh, near Cairo.

It is announced that Pfeiffer has found an efficacious and
reliable antitoxin for typhoid fever.

Dr. W. M. L. Coplin, of Philadelphia, has been appointed
bacteriologist to the Pennsylvania State Board of Health,
and Dr. Richard Slee of Swiftwater, Dr. Nelson F. Davis,
of Bucknell University, and Dr. Robert L. Pitfield, of
Germantown, assistant bacteriologists.

The widow of Baron Maurice Hirsch, of Vienna, has
resolved to present two millions of francs (£80,000) to the
Pasteur Institute, as a memorial of her husband.—English
Mechanic.

MICROSCOPICAL NOTES.

Mrs. J. E. Reeves, 201 McCallie Ave., Chattanooga,
Tenn., has 35 or 40 dozens of "unnamed" slides to sell.
They are the last work of her late husband, Dr. J. E.
Reeves. She has also as many or more of "named" slides.

A good microscope for sale cheap.   Pacific Medical Journal Office, 603 Sutter St., San Francisco, Cal.

Barbados.—The official papers of Barbados spell the word as above and not as we have heretofore given it in the articles of certain contributors—Barbadoes.

A small crystal of Thymol will preserve urinary sediments.

There is now once more a University of Paris.   The inauguration has been celebrated in the new building of the Sorbonne.

The twelfth International Congress of Medicine will take place from August 19th to 26th, 1897, at Moscow.

It is reported that a lady has presented the French Academy with 800,000 francs, the interest of which is to go to any one who will discover a cure for consumption.

The annual budget in Paris for the Assistance Publique amounts to the large sum of $8,000,000; of this the medical and surgical personnel receives $200,000.

A report comes from the Medico-Surgical Society of Antwerp of the discovery of an antitoxin for pneumonia by Dr. Mennes, of Louvain.   The microbe is stated to be extremely small, of a shape approaching an oval.   At present successful experiments have been confined to animals. —English Mechanic.

Ink for Writing on Glass.—Shellac 20 parts, alcohol 150 parts, borax 35 parts, water 250 parts.   Water soluble dye, sufficient to color.   Dissolve the shellac in the alcohol, the borax in the water and pour the shellac solution slowly into that of the borax.   Then add the coloring matter, previously dissolved in a little water.

Dr. Sidney Yankauer of New York County, exhibited at the thirteenth annual meeting of the New York State Medical Association, 1896, a simple and inexpensive microtome which he devised.   With the model shown he said he had cut sections in celloidin a thousandth of an inch thick, and in paraffin sections only one five-thousandth of an inch thick

HISTOLOGY OF THE STRIPED MUSCLE

The Striped Muscle Fibre: A few Points in its Comparative Histology.

BY LOUISE TAYLER,

PATTERSON, N. J.

(With Frontispiece.)

The striped muscle fibre has been the centre of interest for many years. This may be seen from all books touching upon the subject found in any biological library. Perhaps the most work has been done toward determining the ultimate nature of the cross striping, and in other regards it has had less attention. In the few notes here offered, some points of a different nature are presented; points not so generally presented in those discussions.

The muscle tissue of the following animals has been examined in regard to these points:

    1 The Elasmobranch,   2 Frog,
    3 Turtle,   4 Snake,
    5 Pigeon,   6 Rabbit,   7 Cat.

Before taking up this discussion a general review of striped muscle may be of use. The mass of skeletal muscular substance is collected into distinct organs, muscles, the most of which are attached by means of fibrous

DESCRIPTION OF THE FRONTISPIECE.

1. Transection of striped muscle; frog.
2. Transection of striped muscle; rabbit.
3. Larger section of striped muscle fibre; frog.
4. Same as Fig. 1, enlarged.
5. Transection of striped muscle fibre; turtle.
6. Transection of striped muscle fibre; pigeon.
7. Same as in Fig. 2, enlarged.
8. Transection of striped muscle; 13-day chick embryo.
9. Transection of striped muscle; 20-day chick embryo.

connective tissue to some firm part upon which they may
act (Fig. 1, 2). The whole muscle is enclosed within a
connective tissue sheath. Each muscle is divided into
bundles called fasicles, which are also surrounded by
sheaths of connective tissue. The fasicles again are
divided into individual fibres, which are separated by
very similar connective tissue sheaths from each other.

These fibres, the structural elements, are elongated
transversely striated cells, or rather fibres, composed of
two distinct parts, the sarcolemna and the sarcous sub-
stance. The sarcolemna is a thin transparent and elastic
sheath. The sarcous substance is a semi-fluid with the
appearance of alternate dark and light bands and also
of longitudinal striations. This substance is the essen-
tial part of a muscle fibre. It is not yet certain whether
the covering or sarcolemna fits over this sarcous sub-
stance like a glove finger or whether it is connected
structurally with it.

Very complex theories have been proposed concerning
the ultimate structure of the muscle fibre; the simplest
and that most in harmony with the probable structure of
other cells is as follows: The protoplasm of the fibre is
composed of a network of threads. This network, in-
stead of being arranged irregularly as in most cells, is
arranged regularly in longitudinal and transverse threads
(Fig. 3). These threads cross each other at right angles
and at points of crossing, enlargements like beads are
formed. The enlargements optically run together across
the fibre, making the dark bands, the thin parts between
appearing to form light bands. Owing to the fact that
the longitudinal threads are stronger than the transverse
threads, there is a tendency for the fibres to break up
into longitudinal elements known as fibriles.

In a transverse section each muscle fibre shows a divi-
sion into a number of small polygonal areas, known as
Cohnheim's areas. These are composed of bundles of

fibrils and bear a similar relation to the fibres that the fasicles do to the muscle.

Each fibre, moreover, contains nuclei. They are oval bodies, the long axis usually placed paralled with the long axis of the fibre (Fig. 3). The position of nuclei varies greatly in the different animal forms and for this reason special stress is laid upon it in this discussion. The points to be emphasized are, the position and number of nuclei imbedded in the sarcous substance and the relative sizes of the different fibres. The animals have been chosen from widely varying classes to give a fair representation of all types. They are taken up in order, according to their classification in the animal kingdom.

The fish representative is an elasmobranch, the dogfish. Its striped muscle fibre is long and cylindrical as is usual. At its ends it tapers suddenly, the striated condition is lost and only the connective tissue covering stretches out into muscle attachment. The fibres vary in width but an average diameter of twenty fibres, as shown in section, is 74 microns. The nuclei are imbedded in the sarcous substance and only rarely is one found by the edge, making but eleven per cent of the whole number in this position.

The frog is the amphibian representative (Fig. 4). The different fibres vary greatly in width, those nearer the outer edge of a muscle section appearing much smaller. This may be due to the fact that the fibres terminate on the outer edge in the sheath of muscle. The average diameter of twenty fibres as shown in section is 66 microns. The only measurements found mentioned are those given by Gage (Reference Handbook of Medical Science, Vol. V. p   ): the approximate width is 56 microns for amphibians. 87 per cent of the nuclei are imbedded in the sarcous substance. A transection of a fibre shows from one to six nuclei. The frog is quite a

differentiated amphibian and for that reason these points may differ in the more generalized forms.

The turtle representing the reptiles, differs from the frog (Fig. 5). The muscle fibres appear in transection a little more angular and the diameter is smaller. An average of twenty measures 55 microns, in the turtle. 77 per cent of the nuclei are imbedded in the sarcous substance. This shows and advance in one line, over the frog.

The pigeon is considered next (Fig. 6). This animal though not belonging to the highest class of mammals belongs among warm blooded animals. Naturally differences are to be expected between this and the cold blooded forms. The first difference noted is that the fasicles are more distinct. The average diameter of twenty fibres is 24 microns. The nuclei are found to a great extent at the edge and only 3 per cent are imbedded in the sarcous substance.

Turning to the mammals, one finds still more differences (Fig. 7). The fasicles in the rabbit are much more distinct than has yet been found and are surrounded by more connective tissue. In section, the individual fibres are far more angular, making the form more prismatic than cylindical,—an average of 20 diameters 25 microns, less than one-half the size of the frog. The rabbit's fibre has only ½ per cent of its nuclei imbedded in the sarcous substance. This leaves by far the greater number at the edge, projecting out, even push out the sarcolemna. The cat's muscle is very like that of the rabbit though there is more connective tissue between the fasicles and also between the fibres themselves. This may be due to the greater activity and strength in the cat than is possessed by the domestic rabbit, necessitatting a large blood supply and firm binding of parts together. An average of 20 fibres in diameter measures 24 microns, and none of its nuclei are imbedded in the sarcous substance.

There is a wide difference between these last fibres examined and the first; the results are expressed in the following summary:—

	Average Diameter.	Average per cent of nuclei imbedded in sarcous substances.
Dog-fish,	74 microns	89 per cent
Frog,	66 microns	87 per cent
Turtle,	55 microns	77 per cent
Pigeon,	24 microns	3 per cent
Rabbit,	25 microns	$\frac{1}{2}$ per cent
Cat,	24 microns	0 per cent

This table shows a gradual change in the muscle fibre from the more general to the specialized animals; the size of the fibres not only gradually grows smaller and generally more angular but they are more surrounded by connective tissue. The nuclei gradually approach the edge and in the highest forms are even pushing out, making projections on the surface of the fibres.

There is a large gap, however, between the cold blooded and warm blooded animals, giving two distinct groups, both in diameter of fibre and per cent of nuclei imbedded in the sarcous substance.

FACTS FROM EMBRYOLOGICAL FORMS.—There is a suggestion that perhaps some intermediate forms could be found—unless variation is dependent on physiological conditions wholly—in developing muscle in embryos. By a study into some developing tissues of the chick embryos of 13, 16, 18 and 20 days, the series of changes observed is both interesting and suggestive. The series begins with irregular ill-defined cells (Fig. 8), which in the next stage (16 days) shows clearly defined fibres with centrally placed nuclei. The next stage, in transection shows in a cell, more than one nucleus generally centrally placed and the last stage examined (Fig. 9) shows most of the nuclei at the edge of the sarcous substance as in the adult pigeon. The cells, however, are very much smaller than in the adult, the 20 examined

measuring only an average of 10 microns at the 20-day stage. This would be expected from the physiological conditions of inactivity.

FACTS FROM ADULT FORMS.—As the skeletal muscle is looked upon as the most highly developed, consequently an examination of striped muscle which is not voluntary may also throw some light upon the subject under consideration. Of these forms, the cardiac is most suggestive; the fibre in it is much shorter and contains only one centrally placed nucleus. This then is less specialized than the striped muscle fibre of the frog for one centrally placed nucleus is a characteristic of the plain muscle fibre. The question arises, is there any striped muscle, otherwise placed, which may show some difference? The muscle in the esophagus offers a basis for comparison. Sections both longitudinal and transverse have been examined from the various parts of the tubes of some of the animals already noted. The esophagus of the frog has only plain muscle. The rabbit's esophagus has plain muscle fibre at the stomach end, but this gradually changes toward the other end where the striped muscle fibre is like the skeletal muscle in the position of its nuclei. The average per cent of nuclei imbedded in the sarcous substance is $1\frac{1}{2}$ per cent, but the variation from the middle of tube to the mouth end is from 4 per cent to 0 per cent. Nothing like cardiac muscle, in the gradual change, could be observed, though some writers state that fibres become short toward the middle of the esophagus. The cat's esophagus has also plain muscle at the stomach end and gradually changes to striped muscle toward the other end. It has an average of 20 per cent of nuclei imbedded in the sarcous substance. This large number may be due to the fact that the sections, from which the observations were made, were of tissue quite far down this tube. Taking it, however, as correct on the whole, the position of the

nuclei in the striped muscle fibres of the cat's esophagus may be considered less specialized than that of the rabbit's esophagus. It may be regarded as an interesting fact that in the rabbit, the nuclei are quite centrally situated when not at the edge where as in the cat, those in the sarcous substance appear only just off the edge of the sarcolemna.

The embryonic chick esophagus affords interesting gradations too. The earlier stages show distinct cells, each with a central nucleus. They appear in transection as very like plain muscle fibres. In an older embryo, the fibres are more angular, the striated condition distinct and the nuclei both centrally and marginally situated as in the pigeon, with the greater per cent at the margin.

Thus we find a series of adult structures in various animals showing certain marked differences. An embryological series may be made showing variation of a developing structure in one animal that corresponds in general to the series of adult forms. Also intermediate forms may be found in adult animals by considering some part (esophagus) not so strongly voluntary in action.

The table given above, shows that the muscle fibres become more specialized, the higher we go in the animal kingdom. In position of nuclei, the large gap between the cold blooded and warm blooded animals is bridged over by the developing tissues of the chick embryo. It is known that striped muscle develops from cells similar to plain muscle fibres. The facts given above in regard to the striped muscle of the esophagus and chick embryonic tissues illustrate how specialized skeletal muscles develope, from plain muscles and that ancestral forms may be found in the skeletal muscles of the less specialized animals.

Tests For Microscope Objectives.†

By EDWARD M. NELSON,

LONDON, ENGLAND.

Power, practically, has very little to do with the reso-
lution of diatomic striæ with oblique light—eyepiecing
easily remedies any defect on that score; quality of ob-
jective has also (contrary to the usually received opinion)
litle to do with it; a bad objective may be a strong striæ
resolver. The only other factors left, then, are those of
aperture, skillful manipulation, and keenness of percep-
tion. Given the requisite aperture, skillful manipulation
and keenness of perception (assuming that keenness of
vision is present) will come with intelligent practice.

We must in the first place, recognise that some of
the diatoms above enumerated are by no means constant
in the fineness of their structure; consequently, the reso-
lution of their striæ by oblique illumination is no criterion
of the aperture of an objective, neither is it of its quality.

With a ¾ axial cone, *P. angulatum*, dry on cover, is a
good test for the highest quality lenses from ½in. up-
wards. Note, the slide should be what is called a "spread
slide." As a rule, it is better to avoid "selected diatoms,"
especially when mounted dry on cover.

We should also remember that the test lies more in the
quality of the image than in the strength of the resolu-
tion. Therefore, the quality of an image yielded by a
coarse diatom, well within the grip of the objective,

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†In reply to the following questions : (1) for what particular powers are
the following diatoms generally recognised as suitable tests: Surirella gemma,
Pleurosigma attenuatum, Pleurosigma angulatum, Navicula lyra, Gram-
matophora marina, Stauroneis phœnicenteron, Triceratium favus? (2) In
which of the following media are the above diatoms resolved most easily with
dry objectives of suitable power and aperture: Styrax, balsam, mono-brom
naphthalin, mono-brom balsam, or mounted dry? (3) What is approximately
the lowest magnifying power under which, with an objective capable of
dividing Pleurosigma angulatum, the dots may be distinctly discerned by an
eye of average power of vision? (4) Which variety of Coscinodiscus most
easily shows the secondary markings?

affords a better test than a faint striation just glimpsed with a lens barely possessing the necessary aperture to resolve it.

N. lyra.—Two nights ago, I saw one valve in balsam beautifully dotted with a 1 in. on a dark ground. Another valve, however, was so fine, that it required a wide-angled ½ in. to do it.

One of the best diatoms to work on with the higher powers is the large *N. rhomboides,* found in "Sozodont" tooth-powder (discovered in this material by G. Mainland, F.R.M.S.); it is very constant in fineness, the trans. striæ being 60,000 per inch. Zeiss apochromatic ½in. crosses it.

The best test for low-power lenses, say, from 1½ to ¼ or 4-10 of ·6 N.A. is a balsam-mounted diatom with dark ground illumination by Abbe's achromatic condenser and central stop. The stop should be just of a sufficient size to give a perfectly dark ground, and no larger. This test consists in the freedom from scattered light about the diatom. A coarse *N. lyra* does very well; the clear structureless parts of the diatom should be free from scattered light from the neighbouring parts that have structure. Of course, the lenses must be accurately adjusted by the alteration of tube-length. For the higher powers a bright field should be used from a ¾ axial cone, and the finer forms of *Lyra,* or *P. formosum,* or the larger *N. rhomboides* are suitable. These may be mounted in balsam, or better, styrax; or, better still, in quinidine. Quinidine is the best medium, but for some reason or other it is very difficult to work with. I have one of the first slides prepared in this medium which is still excellent; but most of the others in my possession have gone bad. The fact that one of the early slides is perfect shows that mounts in this medium are possible. Why they cannot be multiplied is a mystery I am unable to fathom.

A spread slide of *P. angulatum* dry on cover is an excellent test. The minimum power required to see it in dots with a ¾ axial cone is about 220 diams. I have myself glimpsed it with slightly less, but then the image was very difficult. An old cheap student's ¼ N.A. ·72 showed it with a magnification of 250. Probably some of the modern cheap semi-apochromats would do it with less. The Zeiss apochromatic ½ N. A. ·65 dots it easily with a large axial cone. It has even been seen with this fine lens with the 8 compensating eyepiece. P. and L. old achromatic 4-10 N.A. ·64, power, 290, also does it. All modern students' ¼ and ⅙, semi-apochromatic or otherwise, should do it also.

The golden rule for the resolving power of any objective with a ¾ axial cone of illumination is that they should show a fineness of structure equal to 70,000 multiplied by their N.A. Thus—

TABLE I.

N.A.	Fineness of Structure Resolved.
0·1	7,000
0·2	14,000
0·3	21,000
0·4	28,000
0·5	35,000
0·6	42,000
0·7	49,000
0·8	56,000
0·9	63,000
1·0	70,000
1·1	77,000
1·2	84,000
1·3	91,000
1·4	98,000
1·5	105,000

Table II. agrees very well with Table I. It must be remembered that some of the lenses which apparently do not come up to the rule gave a very strong resolution of the numbers opposite to them; they therefore would probably have resolved a trifle more, but there was not at hand a slightly finer-marked diatom to test them on.

The following table shows what has actually been achieved on diatoms in balsam with a ¾ axial cone. A comparison of this table with the former will be instructive:—

<div align="center">TABLE II.</div>

Objective.	N. A.	Resolved.
Apochromatic 1 in	·32	22,000
Achromatic 4-10	·64	40,000
Apochromatic ½	·66	46,000
Semi-apochromatic ¾	·71	53,500
Achromatic ¼	·79	53,000
Semi-apochromatic 1-7	·86	60,000
Achromatic 1-5	·88	60,000
Apochromatic ¼	·95	65,000
Semi-apochromatic 1-12	1·26	90,000
Apochromatic ⅛	1·43	94,000

I do not know which of the Coscinodisci has the coarsest secondaries. *Asteromphalus* is fairly coarse. Some of the *Triceratia* have very coarse secondaries—*Thumii* may be one of them.

With regard to mounting media, there has been too much made of high refractive index, and too little of spectrum irrationality. Piperine has a high index, but its irrationality spoils it.

The order of merit may be taken as follows:—

1. Quinidine, by far the best; unstable.

2. Styrax, very good and permanent.

3. Balsam, permanent.

4. Monobromide, not good.

Prof. Smith's, Dr. Meale's and Father Thompson's media are uncertain, difficult, and very dangerous to work with.

In conclusion, let me urge workers to procure a Gifford's F line screen for use at the back of the condenser: they are quite inexpensive. They greatly improve the definition, and make cheap semi-apochromats almost equal to the most expensive apochromats; they even improve apochromats, and they increase the resolving power.—English Mechanic.

Notes on Comparative Histology of Blood and Muscle.

By EDITH J. CLAYPOLE,

WELLESLEY, MASS.

There is great difficulty in basing general histology on the various books and discussions of human histology. Even if any mammal other than man is made the object of study there is difficulty since many of the tissues of the cat and rabbit for instance, vary widely from the same tissues in man, while among the still lower forms still greater differences exist. Compound tissues vary largely and even many elementary ones are markedly distinct.

The animals chosen for these few notes were the rabbit, cat, pigeon, turtle, snake, frog, ambleptoma, cryptobranchus, necturus; slightly amia, a ganoid fish and protopteus, a dipnoan fish; only two tissues were examined thoroughly, blood and striped muscle. Others are partly worked out, but not fully enough for discussion.

BLOOD.—This tissue has been very largely worked on owing to its medico-legal importance, interest being centred in the size and number of the red corpuscles. These cells of all animals fall into two natural groups, those with, and those without nuclei. All mammals possess nonnucleated corpuscles: vertebrates, birds, reptiles, amphibians and fishes possess nucleated corpuscles.

From various sources I have collected or made measurements of as many forms in these classes as possible with the following results placed in tabular form.

These figures are suggestive. Variation occurs from 6 to 75 microns, a gradual decrease in size from generalized to specialized forms, both in different members in the same class (salamanders, frogs, cæcilians) and in the different classes (amphibians, fishes, reptiles, birds, and mammals). At each end of the table are specialized forms, not equally so, but both far from primitive, modern

fishes and birds and mammals. The amphibia lie between a class acknowledged to contain widely varying forms, some highly specialized, others exceedingly generalized. The variation in size of red corpuscle corresponds with this range in form. They are small in cæcilians, 18·2x15 very large in amphiuma, a salamander.

OVAL CELLS.

FISHES	L. microns	B. microns		L. microns	B. microns
Teleost			Amphiuma	75.	45.
Carp	15.	9.	REPTILES		
Ganoid			Turtle	10.	6.
Sturgeon	13.	10.	Snake	10.7	12.9
Amia	11.6	8.6	Lizard	{ 16.	10.
Elasmos				{ 13.	10.
Ray	28.5		Alligator	20.	7.
Shark	22.6		BIRDS		
Dipnoan			Fowl	12.	7.
Lepidosiran	41.	29.	Pigeon	12.	7.
AMPHIBIANS			MAMMALS		
Scaly	18.2	15.	Camel	8.	4.
Frog	23.2	16.5			
Toad	24.	16.			
Megalobatrachus	47.	33.			
Cryptobranchus	48.7	29.2			
Necturus	58.4	31.1			
Proteus	58.	35.			
Siren	59.	30.			

CIRCULAR CELLS.

	microns
Man	7.5
Mammals	6.5
Lampery	12.6
Cyclostomes	11.3

There is another striking change in this series. The normal absence of the nucleus from the mammalian red corpuscles and the presence of it in all other red corpuscles is well-known. A brief consideration of the function of the red cell helps in explaining this fact. It is no longer a typical cell, it is very highly specialized for one purpose, to take up oxygen, the more oxygen it can carry the more efficient it is. Hæmoglobine is the essential oxygen carrier in the corpuscle, by crowding out the nucleus more of this substance can be present, hence the corpuscle becomes more efficient. A series can be made showing the gradual loss in different animal forms, large in amphibians, it is reduced to small size in birds and in mammals is gone entirely. Decrease in size follows the same law. Exchange is far more rapid between small masses than between large ones, and small cell elements

result in mammals, shown in blood corpuscles as well as elsewhere.

MUSCLE.—The subject of striped muscle has been much worked on, but some of the minor points are the ones of most significance in this present discussion. It is well known that in mammals the nuclei of the fibres lie just under the sarcolemma or limiting membrane of the fibre. In the frog they lie scattered through the sarcous substance. The size and shape of fibre, number, shape and size of nuclei and also the structure of the sarcous substance as apparent from longisections and transections are of significance. The following animals were used: lamprey, amia, frog, amblystoma, cryptobranchus, necturus, snake, turtle, pigeon, and cat. The results are shown in the following table.

	Size Microns	No. of Nuclei	Location of Nuclei	Coarse or Fine in section
Lamprey	10	1-2	Inside	Medium
Amia	18.9	1-2	"	Fine
Protopterus	35	1-2	Edge	"
Frog	45	2-5	Inside	"
Amblystoma	42.3	2-3	"	Coarse
Cryptobranchus	78.6	2-3	"	"
Necturus	88.5	2-3	"	"
Turtle	54	2-1	"	"
Snake	{ 97.8 { 89.7	3-5 25-35	" "	{ Very Fine { Fine
Bird	20.7	2-3	Edge	Coarse
Mammal	21.1	1-2	"	Fine

Warm blooded and cold blooded animals are sharply cut away from each other with one exception the dipnoan Protopterus, in which, strange to say, the nuclei are at the edge as in birds and mammals. On the whole there is about the same number of nuclei, with one exception to be discussed later. The terms coarse and fine are used to describe the appearance of the fibres in transection. This difference in character is probably due to the varying size of the constituent fibrils in different animals. If they are large, a coarse effect results; if small, a fine effect. The same fact explains the difference in length-

wise view, some show very markedly longitudinal stria-
tions, the coarse ones. In the snake some peculiar con-
ditions were found. Two kinds of fibre shown in tran-
section, one typical coarse grained with 3-4 nuclei,
another very dense with 25-35 nuclei in it. Examina-
tion of longisection shows these to belong to one fibre,
one structure passing abruptly into the other. The
nuclei are small round bodies instead of oval, the only
suggestion as present is that it may be some especial
form of ending.

The general conclusions reached are that in nuclei as
in blood, generalized forms of animals have large ele-
ments, specialized small, in spite of greater muscular
power in latter. The difference in location of nuclei may
be explained by the mechanical disadvantage of a num-
ber of non-contractile masses among the contractile ma-
terial. They interfere with the straight pull, hence in most
differentiated, active animals (birds and mammals) the
nuclei are "pushed to the wall," making the contractile
force all available for locomotion instead of being some-
what dissipated by oblique pulls.

This general law is deduced, — the more generalized the
animal the larger the tissue elements, the more highly
specialized the smaller are the elements. Exceptions oc-
cur of course, but they only serve to prove the rule. Only
two tissues have been discussed here, but an interesting
field of work is opened by this treatment of these com-
ponent parts of animals by the same method as have long
been applied to the study of comparative anatomy.

<center>DISCUSSION.</center>

<center>BEFORE THE AMERICAN MICROSCOPICAL SOCIETY.</center>

Professor S. H. Gage—This subject that has been gone over often has had
a little new life put into it. Miss Claypole has considered it from the phy-
siological instead of from the mechanical standpoint. There are at the pres-
ent day two great schools of physiologists, those that believe physiology is
refined mechanics, and those that believe it is something more than ordinary
mechanics.

This paper has another beautiful feature about it that shows to the older ones as well as to the younger that there is not any subject exhausted yet. Every increase in knowledge makes an old subject a new one, and this subject has been made alive and interesting.

Mrs. S. P. Gage—It has been very pleasing to notice in this study that the evolution of tissues is coming to be considered of equal interest with the evolution of the grosser structures.

Professor E. W. Claypole—We have the evolution of these tissues and of these animals to consider. Unfortunately, from a geological standpoint, we can not get tissues, except in a few cases, to replace what these ancient creatures possessed in the way of tissues. If we trust the embryologist, there must have been some change going on in the course of the evolution of these animals on the earth, and it occurred to me that that is partly connected with the change that took place when land-life first began. As long as the reptiles were confined to the sea the animals possessed the advantage of breathing through their skins, but land-life deprived the animals of the power of breathing through the skin, and that along with the increased burden of breathing through the lungs. The change took place somewhere in reptile life ; that change was accompanied by the necessity for greatly increased oxidation of blood in the lungs.

We then have to consider such a question as this : Why should the camel alone among the mammalia possess these oval blood corpuscles ? That is a question not yet answered by the paleontologists. The lamprey may be regarded as a highly specialized parasitic creature, because it sucks the blood of other creatures. The lampreys can be carried back to the Devonan era, and if they possessed blood discs almost spherical, then these must be prerequisites of very ancient vertebrates. If the lamprey goes back to the Devonian age, it counts among the very early ones.

Dr. V. A. Moore—No tissue is more largely affected in the diseases of animals than the blood, although much is known. Still little is known about its variations, changes and susceptibility to not only the solids but those now going under the name of toxin and antitoxin. This paper opens up the field of the variability of structure of the blood in the same individual regarding atmosphere and temperature, food, and so on. I do not know of an exhaustive treatise on the blood of a single healthy animal, and it is on the healthy condition that pathologists base their status. It is important we should study the condition of the blood in a single specimen.

Disinfection of Mails from Plague Districts.—The Pensylvania State board suggests to the Post-master General, in view of the fact that the plague is a germ disease, the importance of taking the necessary steps to insure the disinfection of all mails coming from districts in which the disease may prevail.

On Soundings from the Pacific Ocean.

BY ARTHUR M. EDWARDS. M. D.

NEWARK, N. J.

In February, 1877, there were submitted to me by the California Academy of Science certain soundings brought home by Commander George E. Belknap of the U. S. S. "Tuscarora" which were taken in the Pacific Ocean with an understanding that I should make a microscopical examination of them and submit a report thereon. Being called away to the Eastern coast by illness, I was unable to do so until lately. I then made a partial report because I had already made certain discoveries that the soundings brought to light. A fuller report has waited the obtaining of further samples. The discoveries made and herein suggested, bear on the soundings from the Atlantic Ocean, as well as the Neocene rocks of California and also of the Eastern coast of North America and elsewhere. The report made was only temporary, (First) because of the imperfect state the specimens were in, being dry and old; and (Secondly) because they are so incomplete, there being many in the list which I will detail further, and which at this time I do not have, and (Thirdly) because this branch of science is in a very unsatisfactory state. Hence a report at the present time must be to a certain extent unsatisfactory. But their examination does not interfere with the discovery which I have now to report and which may seem important.

The specimens were one hundred and eighty-four in number and will be described in detail hereafter.

Lately I came across a thin volume, which is called : "Synopsis of the cruise of the U. S. S. Tuscarora from the date of her commission to her arrival in San Francisco. Cal., Sept. 2, 1874. Compiled by Henry Cummings, San Francisco, 1874." This gave me a list of all the soundings made. They are from Cape Flattery to San

Francisco, from Cape Flattery to Atcha (Aleutian Islands)'
from San Francisco to San Diego, Cal., from San Diego,
Cal., to Honolulu, H. I. to Port Lloyd, Bonin Islands,
from Bonin Islands to Yokohama, Japan, and from Yok-
ohama, Japan to the Island of Tanaga (Aleutian Group).

One of the soundings of which unfortunately the label
was destroyed, but which from other evidence seems to
be from somewhere near the Sandwich Islands is of con-
siderable interest, for it appears to be correlative, if it is
not of the same date, with what was taken by H. M. S.
"Challenger" in the South Pacific. But the Tuscarora
sounding is from the North Pacific. It also is the same
as was secured by Sir J. D. Hooker in the Antarctic
region and is described in the transactions of the British
Association for the Advancement of Science. Oxford
meeting, 1847.

The forms of Bacillariaceæ (Diatomaceæ) were in the
Tuscarora specimens as follows:

Actinocyclus ehrenbergii, J. R.
Actinoptychus undulatus, C. G. E.
Arachnoidiscus ehrenbergii, J. W. B.
Asteromphalus
Biddulphia aurita, L.
Chætoceras gastridium, C. G. E.
          monicæ, A. G.
Coscinodiscus excentricus, C. G. E
          patera, C.
          radiatus, C. G. E.
          umbonatus, C.
Cyclotella astræa, F. T. K.
Denticula elegans, F. T. K.
          palea, N.
Fragilaria pacifica, A. G.
Grammatophora tropica, F. T. K.
Isthmia
Podosira hormoides, M.
Rhizosolenia
Synedra jeffreysii, G. D.
Thalasicolia traunfeldii, (G.) C.

A specimen I have from H. M. S. Challenger sound-

ings, which is labelled as from 1950 fathoms, contains
in it:

    Actinocyclus ehrenbergii, J. R.
    Actinoptychus undulatus, G. G. E.
    Arachnoidiscus ehrenbergii, J. W. B.
    Biddulphia aurita, L.
    Chœtoceros gastridium, C. G. E.
            monicæ, A. G.
    Coscinodiscus patera, C.
            umboniatus, C.
    Denticula palœa, N.
    Fragilaria pacifica, S. G.
    Grammatophora tropica, F. T. K.
    Podosira hormoides, M.
    Synedra jeffreysii, G. D.

The same forms are to be found in the Neocene of California whenever it has been examined, from Crescent City in Del Norte county on the north to a spot about forty miles south of the southern limit in Southern California, that is to say into Mexico. They are the same in the infusorial earth of the Atlantic Coast of North America, and likewise in South America when it has been detected at Payta and Mejillones in Peru. In North America it is known as Miocene territory and is seen at Atlantic City in New Jersey, at Richmond in Virginia, at various points in Maryland, as at Nottingham, and at Tampa Bay in Florida. It is likewise known at Oran in Africa, at Moron in Spain, at Mors in Denmark, at Catanisetta in Sicily, at Simbirsk in Russia, and at Senz Peter in Hungary. Besides, it is known at Netansi in Japan and Oamaru in New Zealand.

And what does this bring us to? We have to compare the forms of Bacillariria, Rhizopoda and Foramenifera of these different localities and we find them essentialy the same in all. We have also to compare the forms of Bacillaria, Rhizopoda and Foramenifera of the soundings in the Pacific and Atlantic oceans and we find them the same. Can we not say that the strata are the same in composition *chemically* and the same in organic forms!

I think they are. And can we separate the Neocene from the recent soundings in any respect ? I do not think so. It has been more than hinted at the likelihood of the Neocene of California being but recent from comparing them by lithographic reasons, and I think they can also be likened from palæontologic reasons likewise. We can not distinguish Neocene Bacilliaria, Rhizopoda or Foramenifera from recent which are living now. Although the strata in New Zealand have been placed in the Cretaceous, and at Simbirsk in the lower Eocene, we must expect to see them bearing like forms to the recent, and which live more on the bottom of the ocean and are in every inlet along the coast.

Practical Methods of Demonstrating Tubercle Bacilli.

By W. N. SHERMAN M. D..

MERCED, CAL.

When we consider the rapid progress of medical science, we must realize the vast field of literature with which the general practitioner should familiarize himself, in order to keep posted. With such conditions confronting us, we must economize our time and adopt methods, that are shortest and quickest, in enabling us to reach conclusions and to obtain results. For this reason the tendency of the science of bacteriolgy is to teach methods by which we can most quickly reach results, and thus make a quick and sure diagnosis of contagious and other diseases. In such diseases as cholera and diphtheria, a skillful bacteriologist may, within 24 hours, establish a positive diagnosis, by means of the microscope. In cases of tubercular disease of the lungs, a positive diagnosis may be established in fifteen minutes, when the most careful and skillful physical examination may have failed to reveal the slighest lesion.

The various methods of examining sputa for the tubercle bacillus would only seem to confuse the beginner, unless he had ample time at his disposal. Numerous modifications of the orignal Koch-Erhlich method have been recommended and adopted, the constant aim being to simplify and shorten the *technique* without detracting from its reliability. Biedert has recently recommended the following method for demonstrating the bacilli when they are scant in number. A teaspoonful of sputum and two teaspoonfuls of water are boiled with 15 drops of solution of caustic soda, then four teaspoonfuls of water are added and the whole again boiled until it forms a homogenous fluid. It is allowed to stand for two days (not longer) in a conical glass, when the bacilli and elastic fibers form the sediment, which is to be stained by the Ziehl-Neilson process. When one is not accustomed to examine for the bacillus tuberculosis, for the purpose of controlling the degree of staining, he should, at the same time, stain some sputum that is known to contain the bacillus, or else keep a few test slides on hand.

Another method of preparing the sputum, is the method of Dahnen: the sputun, contained in a vessel, is heated (not boiled) in boiling water, thus precipitating the solid substance and the bacilli, which can be examined at once. The digestive method is a substitute for the Biedert method, and is superior in many respects. The sputum is introduced into a test tube, and the digestive fluid added; which is 1 per cent of hydrochloric acid containing pepsin. The test tube is then placed in an incubator or water bath, at a temperature of 98.6° F. for an hour, when it is removed, shaken and allowed to sediment. Before spreading on the cover glass the fluid must be rendered alkaline by adding a drop or more of caustic potash. The staining is done in the usual way.

It is best for the beginner to choose a simple and easy

method of staining, and to stick to the one method, as by constant practice he becomes more skilled. It is always best to prepare a number of slides from each specimen, as some of them may fail to show the bacilli.

The simplest and quickest method of staining is that of Gabbet, and it requires but two solution, which may be preserved for months. The cover glass, prepared and dried in the usual way, is placed for two minutes in a solution of 1 part of fuchsin in 100 parts of a 5 per cent solution of carbolic acid. and 10 parts of absolute alcohol. It is best to warm this solution. The cover glass is next removed from this solution, rinsed in water, and placed for one minute in a solution of 2 parts of methylin blue to 100 parts of a 25 per cent solution of sulphuric acid. It is again rinsed in water, then in alcohol; and dried and mounted in balsam. The preparations made by this method are very beautiful and permanent.

The method which I employ is that of Pittion and Roux. With this, more time is required, and more skill in manipulation; but when skillfully used, the bacilli are larger and more distinct than by any other procedure. Three solutions are used, and all should be fresh except the first. Sol. a is 10 parts of fuchsin in 100 parts of absolute alcohol. Sol. b, 3 parts liq. ammon. in 100 parts distilled water. Sol. c, alcohol 50, water 30, nitric acid 20, aniline green to saturation; dissolve the color in alcohol, then add the water and next the acid.

To use, take of a 1 part and of b 10 parts, heat until vapor appears, and float cover glass in usual way for about two minutes, then rinse in distilled water, and place in solution c until the red color disappears, then wash and mount. It takes some experience to know just how much to decolorize.

The tubercle bacilli are distinctly recognized by their red staining. With a good specimen and careful staining by this method the bacilli appear as large under a

dry 1–5 objective as under a 1–10 immersion objective
by staining processes. Their presence in the sputum is
a sure indication of tuberculosis of the lungs or larynx.
Quite a close approximation of the severity of the disease
may be made by the number of bacilli, but more closely
by the quantity of the spores. Bacilli are often dis-
covered when the physical signs are still indistinct or
altogether wanting. Absence of the bacilli at a single
examination is without value.

These slides [specimens exhibited] are stained by the
two methods last mentioned, and are from the sputum
of a patient under treatment with Edison's aseptolin
since February 22, 1896. The expectoration has contin-
ually decreased in quantity, but there seems to be little
effect, if any, upon the form and number of the bacilli.—
Occidental Medical Times.

EDITORIAL.

Le Naturaliste Canadien.—The scientific publication of
that name, founded by l'Abbe Provencher and edited at
present by l'Abbe V. A. Huard of Chicoutimi, Canada,
enters with the January number upon its 24th year. We
wish success to one of the oldest pioneers of learning in a
country where natural science has comparatively few
votaries.

Diatomaceous Earth Free.—Mr. K. M. Cunningham,
having in the month, June, 1896, discovered a new Fossil
Marine Diatomaceous deposit near Suggsville, Clarke Co.,
Ala., which deposit has characters closely approaching the
deposits of Richmond, Va., and Monterey, Pacific Coast,
and further having in the month of December past, secured
some fifty pounds of the material for distribution to any-
one, makes a free offer to our subscribers who may en-
close to us postage at the rate of one cent per ounce. The
material contains twenty-five or more genera of Diatoms.

many species of Foramenifera, sponge spicules, Radiolarians, Coccoliths of the chalk, stellate spicules crystals of selenite, and is a rich clay that can be studied with ease by experts or amateurs in microscopy.

Pritchard's Infusoria.—We have for sale a copy of the latest edition of that beautiful work with colored plates. Price $30. Also Smith's British Diatomaceæ, two volumes, uncut. Price $30. These works are very scarce and can only be got, as in this case, when a microscopist from Europe finishes using them. We trust that some scientific society or public library will be desirous to possess them, since they are very rare volumes.

The Pasteur Gardens.—The muncipality of Mexico has given the name of Pasteur to the gardens situated in front of the National School of medicine in that city.

Monumental.—A conflict more windy than sanguinary arose between Surgeon General Sternberg, of the United States Army, and Surgeon General A. L. Gihon, of the United States Marine Hospital Service, retired. General Sternberg made a motion at the American Public Health Association that the secretary be requested to accept contributions for a monument to Pasteur, and he suggested that each member contribute a dollar for the cause. This brought General Gihon to his feet with a jump. For years he had been trying to raise funds for a monument to Benjamin Rush, whom he considered to have been the greatest American physician, and he moved as an amendment to Dr. Sternberg's motion that each member that contributed $1 to the Pasteur monument should be called on for $10 for a monument to Benjamin Rush. The amendment was declared out of order, and Dr. Gihon submitted a motion similar to that of Dr. Sternberg, with Rush's name instead of Pasteur's. All of the resolutions were referred to the Executive Committee.

Professor Nocard of Alfort, near Paris, has received the award of the Lacaze prize, $2000 in value, for his researches in animal tuberculosis.

PRACTICAL HINTS.

By R. H. WARD, M. D.

TROY, N. Y.

A Simple Expedient in Focusing.—I have just noticed that one intended suggestion, which is perhaps curious enough to be worth noticing separately, was inadvertently omitted in putting in order my article on "Focusing Upward" in a former No. of THE MICROSCOPE.   In the method there recommended as the only safe one for the inexperienced, and the best one for all, of looking horizontally through, between the objective and the slide, until the lens is near the slide without touching it, there is often difficulty, in certain arrangements of the microscope and the light, requiring light to be thrown through by a hand mirror, or a bright background to be presented by holding up, in suitable position and light, a piece of white paper or card.   In such cases it is often very easy to trace the descent of the lens by looking obliquely downward and viewing the reflection of its lower face from the surface of the slide.   This method, which is familiarly and safely used by the expert, is however a critical one, and excessively dangerous to the rash and inexperienced, especially if not thoroughly familiar with optical principles and appearances.   The working distance of the objective is not shown directly, as in the former case, but obliquely and it may easily be misjudged; and the end of the mounting of the objective is not always what or where it seems.   There are of course, moreover, four reflections in dry mounts, from the top and bottom each of the cover-glass and the slide, though two of these are naturally obliterated by "medium" in other mounts, and the deeper reflections are not usually distinct enough to mislead, even if noticed at all.   This method, however, should not be used by beginners, nor ever with objectives or slides that are not the property of the manipulator; as a slight misunderstanding would cause a fatal accident to slide or objective, if not to both.

Preservation of Library Mucilage.—The recent discussions, in THE MICROSCOPE and elsewhere, of methods for preparing permanent mucilages and pastes for the library or study table, seem to leave little need of addition, except to give a caution that salicylic and carbolic acids, lately recommended as preservatives by a very high chemical authority, are wholly unsatisfactory. Antiseptics of this class soon turn the whole stock to a red color which is said to be due to action upon the metal of the brushes commonly used in the mucilage bottle.

For those who prefer an off-hand method wholly free from the delay and trouble of making up a special formula the camphor method is probably the best.   You simply drop a lump of camphor, about as large as a bean or half of a chestnut, more or less, into the bottle of mucilage, and then use and replenish the supply just as if the lump was not there.   It does no harm there, but keeps the solution so saturated with camphor that it cannot mould or ferment.   When the supply of mucilage becomes low, you drop in some gum Arabic powder, and pour in and stir in some cold filtered water, and it is ready to use in two or three minutes.   When you happen to notice, after some months, that the piece of camphor is very small, you drop in another piece.   And that is all.   I have used this method a great many years, and have never seen it fail.

For Moistening Envelopes, postage stamps, and gummed pasters generally, I have found, after trying also various fancy arrangements that have been introduced, nothing so practicable for general library use (excluding perhaps some business uses where the employment is almost constant) as a second mucilage bottle and its brush, supplied with filtered water.   A mere trace of gelatin or gum added to the water makes it more manageable, by giving a little body to it; though this is by no means necessary, and though it greatly hastens the deterioration of the stock by keeping.   A lump of camphor floating on the liquid, as a preservative, will, in either case, keep it in a neat condition much longer than without.   It ought to be no longer necessary to say a word in favor of some such expedient in-

stead of the filthy fashion of licking pasters; to say nothing of the certainty of irritation and discomfort, and the evident danger of serious disease, from the sawing of harsh edges of dry paper across the tender surface of the tongue.

MICROSCOPICAL MANIPULATION.

Stable Picro-Carmine Solution.—A satisfactory picro-carmine, yielding a solution that has been proved to keep good for five years, may be made as follows:

Pure carmine is dissolved in a mixture of ammonia water 1 part by volume and water 4 parts, care being taken to keep the carmine in slight excess. After standing for two days filter the solution, and expose it until a precipitate begins to form, protecting it from dust meanwhile. Again filter, and add concentrated solution of picric acid (? to excess), then agitate and set aside for 24 hours, when a third filtration must be followed by the addition of 1 part of chloral hydrate to every 1,000 parts of solution. At the end of a week filter for the last time, and immediately bottle off in small, glass-stoppered vials.

Stain for Tubercle Bacilli.—Hardin W. Bright, M. D., Professor of Histology, Pathology and Bacteriology in the Tennessee Medical College, sends us the following: Place three drams water in test tube, add five drops alboline. Shake thoroughly, then filter. Of above filtrate 100 parts Sat. aqueous sol. Fuchsin ten parts, 80 per cent alcohol ten parts. The above solution will keep better than if aniline oil be used.

Stain ten minutes in above solution, decolorize, in 30 per cent Nitric acid, wash in alcohol, stain three minutes in aq. Sat. Sol. Methylene Blue, wash in water, dry and mount in Canada balsam. The above stain is an improvement over Ehrlich's. I find it unnecessary to warm solution. I have a specimen stained by this method which I have kept for over one year and the bacilli are as distinct as when first stained. The envelope can be clearly differentiated from the stained protoplasmic contents of the cell.

Revival of an Old Histological Method for Rapid Diagnosis.—Dr. A. A. Kanthack and Mr. T. S. Pigg found, of all rapid methods of hardening tissue, that of immersing small blocks in boiling water for three or four minutes or in the case of delicate tissue one minute, was the most rapid. The tissue could then be at once cut on the freezing microtome, and the section stained well with logwood or other dyes; or it could be preserved in alcohol or Muller's fluid, or treated by the paraffin method. For rapid diagnosis in the case of surgical operations, it was particularly valuable. —British Medical Journal.

Stains for Vegetable Tissues.—Dr. E. Vinassa has investigated the value of aniline colors for staining vegetable tissues, and divides them into three groups only: safranin, congo-red, benzopurpurins, etc.; those affecting lignified tissues, collenchyma vessels, and nuclear sheaths —vesuvin, Victoria green, chrysoidin, violet, methyl green, fuchsin, etc.; and stains that merely differentiate, such as Victoria blues B, RRRR, and BB, which color the thickened cells darker than the surounding tissue, and thus render them more conspicuous. To ensure sections being well stained, all protoplasm, etc., must be got rid of. This is effected with soda lye, washing with much water (acidified with acetic acid if necessary), and then allowing to drain. Afterwards immerse in a ½ to 1 per cent lukewarm stain solution for two or three minutes, and again wash until the water runs clear.

For double staining, first put sections in the stain affecting the lignified tissue, thickened cell-walls, etc., wash well and transfer to stain for parenchyma. This should be heated to 100 C. and rendered slightly alkaline. Colors which are fast on cotton were found to stain parenchyma, whilst those that dye wool or silk directly stain the thickened cell-wall, etc. Suitable mordants (tannin, acetate of lead, etc.) for fixing the colors must be found by experiment.

The sterilization of Milk.—J. A. Forret has examined various methods for the sterilization of milk and finds that

the best results are obtained by placing the jar containing a pint of milk into a tin vessel filled with 3 pints of water in such a manner that the water and milk are at about the same level when the jar is supported about half an inch from the bottom. The water is then heated until it boils, after which the milk is allowed to remain in the water for 15 minutes. The water should boil in not less than 25 minutes and the milk must be stirred continuously to prevent the separation of the cream.

Plants Growing Under Microscope.—Procure a little Collomia seed. Take one of the seeds and with a razor cut off a very tiny slice, place it on a slide, cover with a cover-glass and place under the microscope. The instrument must be in a vertical position. When it is well focused and lighted, moisten it with a drop of water. The seed will absorb the moisture and throw out a very large number of spiral fibers, giving the appearance of veritable germination. Beginners will find it easier if one applies the moisture while the other looks though the instrument.

Storax as a Mounting Medium.—Permanent preparations can be mounted in storax according to Dr. J. H. Piffard if it is prepard as follows: The storax is liquified in a water bath, then filtered through two or three thicknesses of cheese cloth in a hot-water funnel and when cold mixed with an equal weight of xylol. Shake well several times through absorbent cotton or Swedish fitter-paper, and evaporate at a gentle heat, to the consistency of treacle. Finally, to each two parts of the fluid, add three parts of napthaline monobromide, and heat gently until a clear amber-colored fluid is obtained. Probably, the refractive index of the medium should be brought to 1,625 by adding more of the ingredient that may be found deficient, and the product will then be found suitable for work with the highest powers.

Walter White's Botanical Sections.—We have just received from England a new supply of objects and we can furnish at present, almost every number on the list.

BACTERIOLOGY.

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Cheese Curd Inflation its Relation to the Bacterial Flora of Foremilk.—H. L. Bolley and C. M. Hall, use the word "foremilk" to mean the milk from the first part of a milking, not colostrum. Some studies were made on the formation of "pin-holes" in curds which indicated it to be due to the action of bacteria. "Experienced cheese makers have quite generally affirmed that its chief origin is dirty milk." The work upon which this paper is based reaffirms this belief." Preliminary cheese curd and fermentation tests were made at two different times with the milk of two cows, using the milk drawn first, the strippings, and the mixed milk of the whole milking. "The evidence from these tests is that the gas-originating organisms were not located in the udders either in the fore or last milk and that the few 'pin-holes' of the curds must have had an external origin."

Studies were then made of the bacterial flora of the milk of 10 healthy cows, living under healthy stable conditions, from January 22 to April 25. In each, samples were taken of the first and last milk of the milking by means of a sterile silver milking tube inserted well up into the milk cistern. As a result, 16 distinct species of bacteria were isolated, some of which were common to both the first and last milk, and others to only one of these. All the microorganisms found were bacteria, and none were found which produced gas. "The work is given as a preliminary study, and may be said to indicate—(1) no bacterial flora common to the animals investigated, save one peculiar non-milk affecting species; (2) that a given form when once present may be quite constant in its occupancy of the udder of an individual animal. Finally, the absence of gas-producing organisms remains unexplained, but adds significance to the previously described curd tests."

The Constancy of the Kinds of Bacteria in Normal Milk.—H. L. Bolley made, during the summer, cultures of the milk drawn from each teat of three cows. The samples of

milk were obtained in the same way as in the preceding studies, except, that in some cases the milking tube was inserted to different depths. About 60 cultures were made. In all, 37 different kinds of bacteria were found representing various physiological types. "As in the previous studies, there is no evidence that the same species are common to different animals, but the constancy of the occurence of certain types, if present at all, is very apparent. It is plain that the greater number of the germs are found only accidentally at a certain time in a given udder or teat, and perhaps come from the surroundings of the animal. But there are certain single germs which if once found in a teat or udder reappear with a striking constancy."

The Fly as a Germ Carrier.—In 1866, Hoffman demonstrated the presence of tubercle bacilli in the bodies of flies captured in a room occupied by a consumptive. The droppings of the flies were full of bacilli, which were shown by experiment to be fully virulent.

Six years later, M. A. Coppen Jones, of Switzerland, proved by means of chromogenic bacteria that infection can be, and actually is, carried, not only in the bodies of flies, but also by their feet. In the experiment, cultures of the bacilli prodigiosus were mixed with tuberculous sputum. Flies which had been in contact with this mixture were permitted to walk across the surface of sterlized potatoes. In forty-eight hours numerous colonies of the bacillus prodigiosus were visible.

From these results we may reasonably conclude that flies are a constant source of infection.—Modern Medicine.

Infectious Character of the Feces of Tuberculous Cattle.—Scientific research is constantly bringing to light new methods by which tubercle bacilli are communicated to human beings. The *Bulletin Medical* recently published a report of a series of experiments conducted for the purpose of determining whether these bacilli are to be found alive in the excreta of cattle. A young bullock was fed a

meal consisting of bread and a portion of a tuberculous lung. During the three days following, portions of fecal matter were collected and investigated, both by the injection of animals and microscopical examination. Bacilli were constantly found in the feces, and out of fifteen rabbits inoculated, twelve became tuberculous, showing that the fecal matters of tuberculous cattle are as infectious in character as the sputum of persons suffering from this disease.

Rapid Isolation of Bacillus Coli Communis. — Abba gives a new method for "rapid and certain isolation of bacillus coli communis from water." He prepares the following culture medium: Lactose, 20 g.; dry peptone, 100 g.; sodium chloride, 50 g., and water, 1 liter. This may be solidified by the addition of gelatin. Into a liter of suspected water is placed 100 c. cm. of the previously sterilized culture medium; to this is added 0.5 c.cm, of a one per cent alcoholic solution of phenol-phthalim, and afterward a cold saturated solution of sodium carbonate (usually 2 to 3 c. cm. suffice) until the water becomes of a permanently pink color. This water is placed in five or six Erlenmeyer's flasks, and incubated at 37 per cent C. At the same time an agar plate is poured, and is placed in the incubator along with the Erlenmeyer's flasks. If bacillus coli were present in the water, after twelve, sixteen, or twenty-four hours one or several or all of the flasks will then complete decolorization of the contents. The agar plate is inoculated from the surface of one of the colorless fluids; this is again incubated, and in from eight to twelve hours or less a number of colonies will be visible on the surface of the agar. These colonies are examined under the microscope, and cultures made from the ones which most resemble those of the bacillus coli. Under these conditions the bacillus coli rapidly gains the upper hand over most of the other micro-organisms present in the water. The colonies on the agar plates are usually composed of bacillus coli alone, and the first examination leads to their detection, if present.

Excretion of Micro-organisms.—Biedl and R. Kraus have previously shown that micro-organisms present in the blood are excreted by normal kidneys, the urine being free from albumin or blood. These investigators now record their experiments on the excretion of micro- organisms by the glandular organs. By injecting of staphylococcus into the blood, they have investigated the function of the liver and submaxillary gland in this respect. They found negative results in two of the first four experiments where the gall-bladder was opened immediately after death, the precautions being used. In another series of experiments the bile was inoculated directly into nutrient media, a canula having been placed in the bile passages. In case of the submaxillary gland a canula was placed in the duct, and the same method followed. In all these cases the staphylococcus was obtained from the bile, but the results were negative in all cases where the submaxillary secretion was investigated. The micro-organisms were shown to be continuously excreted in the bile during one and a half to two hours, while the experiment lasted. From these experiments these investigators conclude that as in the case of the kidneys the excretion of micro-organisms is a normal function of the liver.

MEDICAL MICROSCOPY.

On the Action of Antitoxin.—Dr. P. Ehrlich states that by the original conception of the destruction of poisons through the anti-bodies it was considered untenable that in physiologically neutral toxin-antitoxin mixtures both compounds still existed as such, but now two opposite opinions are prominent.

According to one view, poison and antidote exist in the liquids of the tissues as a kind of copulative double compound, which is of course inactive in effect. In opposition to this chemical view it has been held by many, especially Roux and Buchner, that the action of the antitoxins is more indirect. They act on the cells, and these to a certain

extent become immunized against the action of the poison. Having in view the complications which arise in experiments on animals, and with a view to substituting as far as possible the reagent glass for the animal organism, Ehrlich has experimented with ricin, a vegetable tox-albumen, concerning which, he says, there is no doubt that in its principal features, immunity to it is similar to immunity to diptheria and tetanus. Ricin possesses the property of coagulating the blood. The blood of a rabbit treated with a series of mixtures of ricin in varying porportions, was injected into six mice. In those cases where the mixture gave a precipitate with blood the animals died; in one case, where the precipitate was very slight, the result was not fatal; in the three cases where the antitoxin was (according to the blood test) present in sufficient or excessive quantity to neutralize the toxin, the animal was unharmed. These facts militate against the cellular theory of Roux and Buchner, and tend to confirm the chemical copulative theory of Ehrlich and Behring, at any rate so far as ricin (castor-oil) is concerned.—B. C. Druggist.

The Function of the Suprarenal Bodies.—Dubois has shown that the principal function of the suprarenal bodies is to destroy toxins present in the circulation, especially those resulting from muscular and nervous activity. The glands contain a peculiar ferment which is capable of modifying organic poisons developed by the tissues or of bacterial origin. A considerable quantity of poisonous liquids is found in the glands.

Scarlet Fever by Mail.—Grasset, on investigating the source of infection in an instance in which a child was attacked by scarlet fever in a place where there had been no case of the disease for years, found that, six days before the child was taken sick, the parents had received a letter from its grand-parents stating that another child in the family had had the disease and was peeling. Two flakes of the convalescent's skin were enclosed in the letter. The parents had allowed the child to play with the letter.—Annales d'Hygiene Publique.

Physicians can Testify as to Stains.—After an examination thereof, both under a microscope and by a chemical analysis, the supreme court of South Carolina holds, in the homicide case of State v. Martin, decided July 11, 1896, that physicians are clearly entitled as experts to give their opinion as to the character of stains found on a piece of floor (*Jour. A. M. A.*). That the latter was not taken from the house in which the defendant lived at the time of the alleged homicide until a few days before the trial, after the defendant had moved from it, and while it was occupied by another person, it is further held did not render it inadmissible in evidence, though the force of the evidence was perhaps weakened by these circumstances.

BIOLOGICAL NOTES.

Rhizopods as Scavengers.—It is interesting to see what a small animal can do as a scavenger. Mr. Thomas Craig, at a meeting of the Natural Science Association of Staten Island, exhibited a bottle, the inside of which had been covered with algæ and a small diatom to such an extent as to make it practically opaque. Upon examination he noticed that a portion near the bottom was clear. A further examination showed that an army of rhizopods were marching in regular order, eating as they went.

The name of the animal is Centropyxis aculeata, one of the lobose rhizopods. The animal itself is only a drop of jelly, in which the highest powers of the microscope reveal no organization of any kind, yet it can travel by means of pseudopodia, which are merely parts of the body protruded from any part of it. By the same means it can sieze its food, convey it inside its body and then digest it, and when all the nutriment is exhausted cast the refuse out. This it does at any part of the mass as it has neither head nor tail.

This particular animal builds a shell for itself, composed of a material like chitin, and grains of sand on the empty shell of diatoms. The chitin is produced by the

animal and is used to cement grains of sand and other material into the proper form of house for this particular species.

Each species has its own form of habitation and it is rare to find them departing from it. The animal is well illustrated in Leidy's Rhizopods.

MICROSCOPICAL NOTES.

Meeting of American Medical Publishers' Association.
The Fourth Annual Meeting of the American Medical Publishers' Association will be held in Philadelphia, on Monday, May 31st, 1897 (the day preceding the meeting of the American Medical Association). Editors and publishers, as well as everyone interested in Medical Journalism, cordially invited to attend, and participate in the deliberations. Several very excellent papers are already assured, but more are desired. In order to secure a place on the program, contributors, should send titles of their papers at once to the Secretary, Chas. Wood Fassett, St. Joseph, Mo.

NEW PUBLICATIONS.

Bacteria in Rocks.—M. B. Renault has long worked at the indications of bacteria found in geological strata, and now publishes the general result of his observations in a paper illustrated with a large number of drawings. As might be expected from their simple structure, bacteria appear to have been coeval with the first appearance of organic life on the earth, the coccoid form being apparently earlier than the bacillar. Indications of their presence are found in bone, teeth, scales and coprolites, as well as abundantly in vegetable tissues, the spores and sporanges of ferns appearing to have been especially subject to their attacks. The species are, as a rule, distinct from those at present in existence.—Ann. des Sciences Naturelles.

MR. ——— SMITH IN HIS STUDY

Notes on Some New, or Presumably New, Infusoria.—I.

By J. C. SMITH, OF

NEW ORLEANS, LA.

(WITH FRONTISPIECE

The classification followed in this paper is that adopted by Saville Kent in his "Manual of the Infusoria."

Family.—Actinomonadidæ. S. K.

Genus.—Actinomonas. S. K.

Species.—Actinomonas primus (figs. 1, 2, and 3).

Body in active flagellate stage cylindrical, variable in form, usually obovate with the posterior continued as a caudal prolongation, sometimes ovate and at other times irregular in shape and nodulate; the largest and usual obovate form about twice as long as wide; flagellum single anterior, equalling one longest body length and vibratile through its whole extent; contractile vesicle conspicuous and located in posterior body half; nucleus round and subcentral; endoplasm hyaline containing to a greater or lesser extent, a number of bead-like granules of a blueish tint, presumably food; locomotion equable, fairly rapid and by revolution on long axis.

Size 1-1250 inch. Habitat—Infusion of aquatic plants

Body in Heliozoan stage variable in form, usually subglobose and undergoing slight changes of contour; rays numerous, fine and projected from all parts of the periphery; equalling in length from one to two diameters of the zooid; flagellum quiescent and coiled close to the body.

This remarkable form was found very abundant and was given prolonged study. In the active flagellate stage it moved about in an easy manner, revolving on its long axis; the flagellum being thrown into graceful curves from its origin to its distal end. After moving about for an hour, more or less, the coming change to the heliozoan stage was ushered in by a slower movement, an occassional halt, slight tremors and the appearance on the anterior body half of short, heavy and blunt tentacle-like processes, with a simultaneous contraction of the body.

If the endoplasm was well filled with the granules mentioned, the body would be modulated. The rays then extended until as long as one or two of its diameters; the tentacle-like processes covering the anterior half, going to form the anterior rays; the flagellum becomes inactive and is coiled close to the body. In this state it resembled very much a light colored Heterophry Leidy, changing its contour gradually and almost imperceptably, but never to any great extent.

The change from the heliozoan to the flagellate stage is heralded by the gradual withdrawal of the rays, the flagellum uncoiling and having a slight movement, a few slight quivers of the body and simultaneous elongation to the original shape of the flagellate; the flagellum becomes very active at once and the infusorian darts off to live for an hour or so in this phase. Sometimes the original form is not restored entirely until it has moved about for a short while, but in all cases observed the original shape was finally assumed.

Each one of the phases of this dual life, as witnessed by the writer occupied from fifteen minutes to one and a half hours.

While in the heliozoan stage the manner of capturing and engulphing food is identically the same as when performed by the Actinophry sol. One form that was un-

der observation for four hours underwent five changes
and during the heliozoan phase captured and engulphed
six large forms of Hexamita inflata (which were abund-
ant), three forms of Cercomonas longicauda and two forms
of Heteromita lens.   From this and a number of similar
observations the writer feels justified in concluding that
this infusorian is truly carnivorous.

Larger infusoria and those of greater consistency
when in contact with the rays were visibly affected; they
seemed to experience a shock, changed their routes and
slackened their pace.   A number of large forms of the
very active Trepomonas agilis were often found among
the rays and were not affected in the slightest manner.
Defecation was observed during both stages, but the flag-
ellate form was never seen to take food.

During the heliozoan stage this form has no locomotive
movement and is not anchored in any way; this last as-
sertion is clearly demonstrated by its being at the mercy
of every current produced by a passing infusorian, worm
or rotifer.

Saville Kent, in his manual of the Infusoria, mentions
an observation of his wherein he witnessed the develop-
ment of an Actinophry from a flagellate zoospore.   In
his figure of the zoospore the contractile vesicle is placed
in the posterior half, and in his figure of the Actinophry
the nucleus is central.   The position of these two essen-
tials corresponds with the form here described.   It may
be presumptuous, but the writer cannot help but incline
to the belief that if the Actinophry had been given a pro-
longed study it might have reverted to its original flag-
ellate state and thus have rendered this record of a new
form unnecessary.

Family.—Heteromitidæ.   S. K.
Genus.—Heteromita.   Dujardin.
Species.—Heteromita ligulata (fig. 4)
Body ovate, cylindrical; one and a half to two times

as long as wide ; plastic and changeable in shape ; ven-
trum slightly concave anteriorly ; flagella originating
together at the anterior extremity , the anterior vibratile
flagellum nearly one half the body length ; this flagellum
is heavy strap-like and of uniform thickness from its ori-
gin to its distal end ; the trailing flagellum from two to
two and a half times the body length ; contractile vesicle
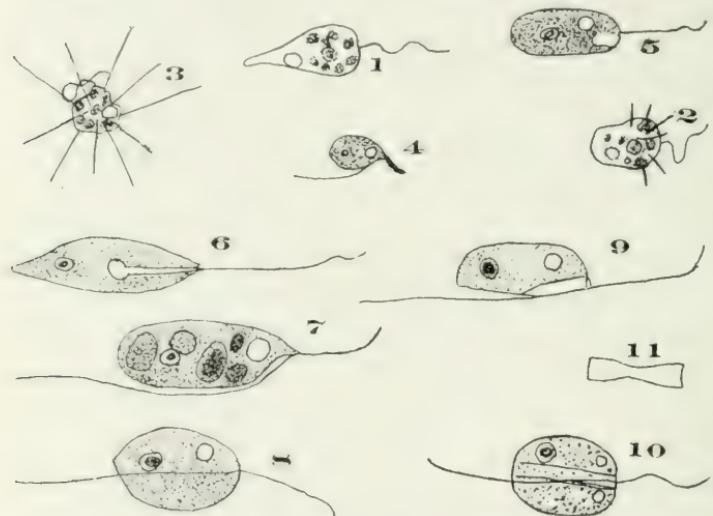
1.—Actinomonas primus.   x 900.
2.—Actinomonas intermediate st...
3.—Actinomonas. Heliozoan obj...
4.—Heteromita ligulata. x 1100.
5.—Petalomonas pusilla. x 2250.
6.—Atractonema fusiformis. x 1750.
7.—Diplomastix rostrum. x 1400.
8.—Diplomastix agilis. x 1200.
9.—Diplomastix latero-ventral view.
10.—Anisonema disomato. x 1250.
11.—Anisonema. Transverse section.

conspicuous and situated close to the anterior extremity;
nucleus round and located in the posterior body half ;
endoplasm, hyaline and slightly granular; locomotion
slow and equable while the anterior strap-like flagellum
is constantly and rapidly wagged. Size from 1-5000 to
1-3000 inch.

Habitat—Ubiquitous.   Transverse fission.

This infusorian has been found by the writer in all kinds of water, fresh and stale, in animal and vegetable macerations; sometimes in great abundance. The anterior flagellum is heavy and strap-like, and is different from any appendage found on any of the flagellata, so far recorded. The movements of this flagellum are more like the wagging of the tail of a pleased dog than the ordinary vibatile movements.

At times this flagellum is bent backwards on either the dorsum or ventrum and no matter how rapid the movements are it does not in the least seem to accelerate the even gliding movements of the body. While the writer has observed a perceptible increase of the granules of food in the endoplasm, he has never been able to detect the inception of such food, but he has a strong presumption that such inception takes place in the slight concavity existing just behind the origin of the flagella on the ventral surface.

> Family.—Paramonadidæ.   S. K.
> Genus.—Petatomonas.   Stien.
> Species.—Petalomonas pusilla (fig. 5).

Body subovate, twice as long as wide; flattened and without a furrow or ridge; Anterior slightly narrower than the posterior; both extremities rounded; sinistral border of greater convexity than dextral border; flagellum equalling a little more than one body length and directed forwards, in a straight line and stiff manner, the distal end vibratile; contractile vesicle conspicuous and located well forwards in the anterior body half and near to the sinistral border; nucleus round and situated, medianly, in the posterior body half; Endoplasm, hyaline and slightly granular posteriorly; locomotion same as all the species; Size 1-3000 inch. Habitat—stale infusion of aquatic plants.

This form is evidently the smallest of the genus so far recorded. Kent in his " Manual of the Infusoria" men-

tions a form—Petalomonas irregularis, observed by himself, which although being a bit larger than this one, bears a close resemblance. He failed to locate the contractile vesicle and the nucleus and in consequence leaves a doubt as to whether his Petalomonas irregularis is the same as this form. This infusorian is dissimilar from any other of the species so far recorded, in being devoid of a ridge and of a furrow. When first observed, the writer was inclined to place it among the genus Para monas, but on closer examination it was found to conform in every detail of habit with the genus in which it is placed.

Family.—Paramonadidæ. S. K.

Genus.—Atractonema. Stien.

Species.—Atractonema fusiformis (fig. 6).

Body fusiform, cylindrical, more than twice as long as wide : widest at the center and attenuate at both extremities ; the anterior transversly truncate ; posterior obtusely pointed and at times produced in a nipple-like process ; pharynx distinct and extending backwards, meeting the contractile vesicle, which is conspicuous and centrally placed ; flagellum more than one body length : nucleus round and medianly placed in posterior body half ; endoplasm hyaline and slightly granular ; locomotion slow and even. Size 1-1400 inch. Habitat—Pond water with algæ.

The small size and the ratio of width to length are all that make this form different from Atractonema teres. Stien.

Family.—Anisonemidæ. S. K.

Genus.—Diplomastix. S. K.

Species.—Diplomastix rostrum (fig. 7).

Body elliptical, cylindrical and variable in size ; from one and a half to three times as long as wide ; anterior truncate obliquely to ventrum ; this truncation being slightly concave and producing the anterior into almost

a point ; posterior evenly rounded ; oval aperture incon-
spicuous but very capacious, situated in the truncation ;
flagella originating together at the apex ; the anterior
one equalling one-half the body length and the posterior
one twice the body length, and much heavier ; contrac-
tile vesicle large, very conspicuous and located well up
in the anterior body half ; nucleus round and in posterior
body half ; endoplasm intrinsically clear and of a blueish
tint, but generally filled with large food grains ; locomo-
tion exceedingly rapid and by revolution on long axis.
Size from 1-2500 to 1-1100 inch.   Habitat—Putrid vege-
table macerations.   Transverse fission.

The movements of this infusorian are so rapid that a
view of the flagella is made very difficult ; especially is
this so in respect to the anterior shorter one.   At times
the posterior longer flagellum is twined about the body.
The oval aperture would never be suspected to exist if
the infusorian was found feeding on bacteria ; it is only
when seen engulphing or attempting to engulph large
particles of food that the position and capaciousness of
the oval aperture can be demonstrated.   The writer had
under observation a specimen that made quite a number
of attempts to swallow food more than thrice its own di-
mensions.   Where it is found with abundance of food
the nucleus and contractile vesicle are obscured by the
large globular food grains it contains.   It is a veritable
scavenger.   A dead Pluronema has been seen surrounded
by dozens of them intent on devouring the remains as
rapidly as possible.

Family.—Anisonemidæ.   S. K.
Genus.—Diplomastix.   S. K.
Species.—Diplomastix agilis (figs. 8 and 9).

Body sub-obovate, compressed; less than twice as long as
wide ; dextral border of greater convexity than sinistral ;
anterior slightly truncate transversely ; dorsum convex

and ventrum plane : the anterior half of tne ventrum traversed by a slight concavity which includes about one-half the body width; flagella originating together near the center of anterior border ; the anterior flagellum equals one body length and is directed obliquely forward to the right side ; the anterior third of this flagellum is vibratile and is flexed still further to the right side ; the posterior flagellum equals nearly two body lengths; oval aperture capacious, situated at the base of the anterior flagellum and conspicuous only when the infusorian is engulphing or attempting to engulph large particles of food ; contractile vesicle large and very conspicuous, located in the anterior body half near the sinistral border ; nucleus roundish and sub-central ; endoplasm blueish and extrinsically granular; locomotion smooth and rapid gliding. Size 1-1400 inch. Habitat—Pond water with algæ.

This exceedingly active infusorian was found in a number of different collections of water taken from a pond in one of the parks in New Orleans. At no time was this form observed until the water had become stale. The oblique direction of the anterior flagellum is not un-like the same appendage of the genus Petalomonas. The ventral concavity is well seen in a latero-ventral view, which it often presents, as it has the habit of gliding through and about debris heaps, after the manner of an Aspidisca, but in a hurried and nervous sort of way. The position and capaciousness of the oval aperture can be verified only by observing the infusorian swallowing or attempting to swallow large particles of food. It often undertakes to swallow particles of food much larger than itself. After it has taken any large particle of food it immediately becomes much altered in shape—but after a few contortions becomes itself again ; it is at this time only that it demonstrates its flexibility.

Family.—Anisonemidæ. S. K.

Genus.—Anisonema. Dujardin.

Species.—Anisonema disomata (figs. 10 and 11).

Body sub-elliptical, less than twice as long as wide; anterior extremity slightly wider than the posterior, and narrowly truncate centrally; posterior rounded; dorsum and ventrum flat and both traversed longitudinally by a deep groove which occupies nearly one-third of the body width; these grooves seem to cut the body in equal halves; flagella originating together near the frontal border and on a line with the slight anterior truncation; the anterior one equals one body length while the posterior one is near two body lengths; contractile vesicles, two, small and located in the anterior body third, one on each side of the grooves; nucleus roundish, in the posterior half near the sinistral border; endoplasm granular and of a greenish tint; locomotion exactly as with Aninnema grande. Ehr. Size 4-1666 inch. Habitat—water from a flower pot.

This form was taken in fairly large quantities from water of long standing in a flower pot exposed to the weather. The grooves give to the infusorian a very transparent line extending the full length of the body. It is when the anterior is depressed and there is a consequent elevation of the posterior border that these grooves can be well observed. The lateral borders of this form are not rounded, but instead are cut off at right angles to the dorsum and ventrum (fig. 11).

The resemblance that this form bears to the Anisonema solenotus of Dr. Stokes is striking and apart from its smaller size would require careful scrutiny to distinguish. The writer has on numerous occasions taken the Anisonema solenotus of Dr. Stokes from pond water in the Audubon park in New Orleans and has thus been enabled to compare them.

(To be continued.)

Some Experiments on the Growth of Diatoms.

By GEORGE C. WHIPPLE.

NEWTON CENTRE, MASS.

In a paper published in 1894 the writer suggested an explanation for the peculiar seasonal distribution of diatoms in lakes and ponds. It was shown that in deep ponds these minute plants are found abundantly during the spring and fall, but are almost entirely absent during the summer and winter; that these growths are closely connected with the phenomena of circulation and stagnation of the water, which phenomena are due to temperature changes; and that it is during the periods of the year when the water is in complete circulation throughout the vertical that the diatom growths occur. The explanation offered for these facts had reference chiefly to the food supply. It was stated that diatoms require a sufficient supply of nitrogen in the form of nitrates, and that they require a free circulation of air, and it was shown how during the "periods of circulation" in the spring and fall these conditions were fulfilled. In the light of more extended observations and experiments this food supply theory, taken alone, is seen to be inadequate, and while it is true that the question of food is one of fundamental importance, yet there are other factors which materially influence their growth. With a view to determining the nature and effect of some of these influences the writer has conducted recently several series of experiments, some of the results of which are here presented.

It is not an easy matter to cultivate diatoms successfully in the laboratory to obtain comparative results. They are organisms which have an extremely sensitive nature, and slight changes in their environment often make great differences in their growth. The temperature, the amount of light, the shape and size of the jar in which they are grown, the action of the glass upon the

water, etc., are all disturbing elements affecting their growth.

In order to determine the effect of light upon their growth it was found necessary to make experiments in the open reservoirs under conditions practically the same as those found in nature.

The method employed was an extremely simple one. It consisted of suspending bottles filled with water from the same source at different depths in the pond, the bottles being tied to a rope which hung from an anchored buoy. After a certain time the bottles were drawn to the surface and the water examined, records being kept of the number of diatoms in each sample before and after exposure. The bottles varied in capacity from 150 to 1,000 cc. In the first five experiments they were tightly stoppered, but in the later ones silk bolting cloth was tied over the mouths of the bottles, and inverted glass tumblers were placed above. The latter arrangement gave much heavier growths on account of providing better opportunity for the circulation of air and for the renewal of food supply.

Without describing the experiments of [Forel Forel, F. A. "Le Leman, monographie limnologique," Lausanne, 1895] and others upon the intensity of light at various depths, it may be said that the decrease in the intensity below the surface is due to two causes—absorption by the water, and the presence of fine particles which act as a screen. The reduction of light in passing through water is supposed to follow the law that as the depth increases arithmetically the intensity of the light decreases geometrically. For example, if the intensity of the light falling upon the surface of a pond is represented by 1, and if $\frac{1}{4}$ of the light is absorbed by the first foot of water, then the intensity of light at the depth of one foot will be $\frac{3}{4}$; the second foot of water will absorb $\frac{1}{4}$ of $\frac{3}{4}$, and the intensity at a depth of two

feet will therefore be 9-16, and so on. At this rate of decrease the intensity of light at a depth of ten feet will be only about 5 per cent of that at the surface.

The following experiments selected from the series may be cited as a typical example of the results obtained:

Cochituate water located in the Chestnut Hill Reservoir, April 29 to May 13, 1895. Temperature, 53°-62°. Color, 0.58.

Date.	Depth.	Asterionella.	Melosira.	Stephanodiscus.	Synedra.	Tabellaria.	Total
April 29	All depths.	94	196	3	11	15	319
May 13	2 ft.	4,040	910	20	22,010	550	27,530
May 13	4 ft.	570	80	10	6,800	120	7,580
May 13	6 ft.	380	650	26	4,510	284	5,850
May 13	8 ft.	650	840	26	1,304	100	2,920
May 13	10 ft.	154	1,380	10	80	0	1,624
May 13	25 ft.	16	432	0	88	28	264

On April 29, the bottles were filled with water from the same source and suspended in the reservoir at the depths indicated in the table. On that date the water contained 319 diatoms per cc. After an exposure of two weeks the bottles were drawn to the surface and the water examined, with the result that the samples near the surface showed an abundant growth, while those which had been kept at a greater depth showed but a slight increase.

The temperature of all the samples was the same and the only facts that varied were the intensity and quality of the light.

In order to better appreciate the relation between the intensity of the light and the diatom growth we may consider fig. 1.

This diagram shows the relative diatom growths at various depths and the corresponding intensity of light

calculated from experiments upon the coefficient of absorption of light by water. The parallelism of the two curves is very striking.

One of the objects of the experiments was to determine the depth below which the diatoms are unable to develop. The results show what we should naturally expect, that it depends upon the character of the water,—its color, turbidity, etc. This is illustrated by fig. 2, which
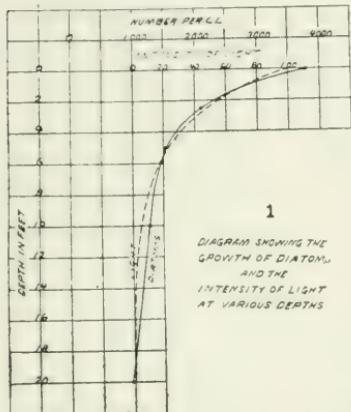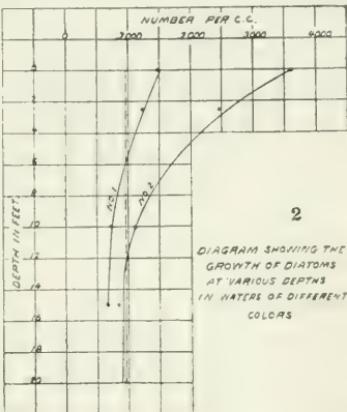
EXPLANATION OF THE DIAGRAMS.

Figure 1.—Lake Cochituate water located in Lake Cochituate, Nov. 29, 1895. Examined Dec. 9, 1895. Temperature 40°-44°. Color 0.33. The intensity of light at different depths was calculated on the assumption that a layer of water one foot in depth absorbs 25 per cent of the light falling upon it.

Figure 2.—Lake Cochituate water located in the Chestnut Hill Reservoir and in Lake Cochituate. The curves represent the average of two series, the first from Nov. 22 to 29, the second from Nov. 29 to Dec. 9, 1895. Temperature 40° to 46°. No. 1. C. H. Res. Color 0.87. No. 2. Lake Cochituate. Color 0.33. The Diatoms referred to in both diagrams were chiefly Asterionella and Melosira.

shows the results of two series of experiments upon water of the same kind located in Lake Cochituate and Chestnut Hill Reservoir. The former had a color of 0.33, while the color of the latter was 0.87. The difference between the two series is very striking. In the light colored water the growths were heavier and extended to greater depths than in the darker water.

Curve No. 1 represents the growths in Chestnut Hill Reservoir, and curve No. 2 those in Lake Cochituate.

The number of diatoms in the original sample is shown by the broken line. The point at which this broken line cuts the curves may be called the limit of growth. In Lake Cochituate this point was at a depth of about twelve feet, in Chestnut Hill Reservoir, six feet.

Diatoms are said to be positively heliotropic, that is, they tend to move towards the light. In some species this power is quite strong; in others it is less noticeable. For the purpose of determining the heliotropism of the diatoms commonly found in water supplies, samples of water rich in diatoms were placed in brass tubes three inches in diameter and thirty-two inches long, having glass ends. One end was covered with a black cap, and the other end exposed to the light. After varying lengths of exposure, portions of the water were drawn from each end of the tubes and examined microscopically. As an example of the results obtained the following may be quoted. Cochituate water containing 922 diatoms per cc. was exposed in a tube for twelve hours. At the end of that time the water at the light end of the tube contained 1,438 and that at the dark end only 320. Some of the tubes were inclined, to see if the diatoms would move upwards towards the light; some of them were placed vertically; in others the diatoms were given time to settle before the exposure was made. The experiments showed that most of the common genera tended to move towards the light while settling, but that having once reached the bottom of the tube they remained where they fell. They apparently did not possess the power of moving upwards towards the light—certainly not through any great depth of water. But while they could not rise of their own accord, slight currents of convection caused by varying the temperature of the water sufficed to keep them near the surface.

The bearing which these facts have upon the seasonal distribution of diatoms is obvious, and we are now better

able to understand why it is that their growths occur during those seasons of the year when the water is in circulation throughout the vertical. During those periods not only is food more abundant, but the vertical currents keep the diatoms near the surface, where there is light enough to stimulate their growth, and where there is an abundance of air. If this theory be true, it must follow that the weather has a marked influence upon their growth. We should expect that the greatest growths would occur on warm, fair days, when there is just enough wind to keep the diatoms near the surface. On quiet days we should expect that they would sink in the water, perhaps below the limit of their growth. During a long period of quiet weather they might sink even to such a depth that they would not again be able to reach the surface.

This is just what took place in Lake Cochituate in the spring of 1895. In this lake there is almost invariably a heavy spring growth of diatoms, but in 1895 the growth was small. It began as usual, the diatoms being apparently in good condition. Early in May, however, there were a few days of uncommonly warm weather. The temperature of the air went above 90°, and the temperature of the surface water on one day was 76°. For almost a week the water was very calm. During this calm weather the diatoms settled rapidly, disappearing almost entirely from the surface. In the meantime the water became stratified, on account of the high temperature of the surface layers, and when once more the wind began to blow, its influence was felt only ten or fifteen feet below the surface. The diatoms, having settled below that depth, were unable to rise, and consequently their growth ceased.

On a Fossil Lake in New Jersey.

By ARTHUR M. EDWARDS. M. D..

NEWARK, N. J.

[Read before the Washington Microscopical Society.]

I wish to record here the finding of a fossil lake in New Jersey; first, because it gives me an opportunity of clearing up the knowledge of infusorial earths and also because I found in it two strata of fossil bacillaria, commonly called diatomaceæ, one below fresh-water and one above brackish water forms. Beside these are growing now and depositing their shells, fresh-water bacillaria. This was the first that I can find containing the fresh and brackish water layers of bacillaria, and should be recorded for that reason alone. But I was, therefore, led to study closely the genesis of similar infusorial earths and I have come to the conclusion that they all, in this country as well as in Europe, are the same lithologically and the same in the forms of bacillaria seen in them.

The earth is clay and so are all of them in North and South America and in Europe. When discovered, it was communicated to the San Francisco Microscopical Society on the 21st of January, 1891. I than called it an intraglacial deposit, it being supposed that it lay between the two glacial moraines which I supposed were here in New Jersey. But then I studied the glacial moraine and I found there was but one in this part of the state. I also learned that glacialists were inclined to place but one in the east, although they were doubtful if there were two in the west. I now call it Iceberg period clay, being formed when the ice of the glacial period was melting and broke into icebergs on the margin. This margin moved further north as the ice melted and at last disappeared. When I found the earth, it was just developed, being turned up by the Lehigh Valley railroad forming a bank across a marsh which I learned had been a lake formerly.

Weequachick lake was known to the Indians but has disappeared now, being left as a marsh with clear places in it where the water was clear but shallow. It is at Waverly, about four miles from Newark and close to Elizabeth. I found first that they were digging for the railroad just south of the Marsh and almost a yard down they turned up a dark, almost black soil. This I secured and examined. I was delighted to find that it consisted of nearly pure brackish water forms of bacillaria. Going to the place where they were digging to secure some more of the earth, I saw that the embankment which was formed of glacial moraine, in this case being in the majority of sand and gravel, had been laid across a marsh which I also learned had been called Weequachick lake. But the soil at the bottom had not been firm enough to bear the weight of the embankment which had sunk, crowding up the bottom of the marsh. At one place, it rose in minature hill, about six to eight feet high. In this place, I collected it, and found it was peaty on top, and, for five feet down, it contained brackish forms of bacillaria, and below that for at least two feet it was made up of fresh-water forms. Beneath all was the glacial moraine which at this place is over thirty feet thick. Where the fresh-water and the brackish water bacillaria joined, there was a mingling of forms, so that one could collect a fresh water infusorial earth having some salt water found in it. Thus, I got Navicula viridis and other forms along with Triceratium favus.

Then I studied the infusorial earths which I had or could procure and I got over a hundred and I found that they all contained essentially the same fresh-water forms. And I collected any clay that occurred everywhere in New Jersey and I found it contained sparsely the same forms. And I came to the conclusion that they were all one in the Iceberg period clays of the world. This is the conclusion I have come to now.

The Microscopical and Chemical Aids to Diagnosis.

By Dr. KATHRINE R. COLLINS.

On October 14th, 1896, before the Tristate Medical Society at Chattanooga, Dr. Kathrine R. Collins read a paper on "Microscopical and Chemical Aids to Diagnosis." The writer takes the position that by these two means valuable assistance to diagnosis may be obtained, but at present it is, too often, the case that these examinations are hurriedly and carelessly made thus bringing about very unsatisfactory results. The examination of one specimen of urine being frequently considered all that is necessary, not as the abnormal constituents of the urine may occur without any coexisting pathological condition, as the presence of sugar or albumen after a meal rich in these substances, the one examination is without value. Also in the microscopical work many conditions may be overlooked in the single examination or the presence of the tubercle bacilli in the sputum of tuberculous patients. Attention is then called to some of the difficulties interfering with the tests for sugar in the urine; the value of estimating the amount of chlorides excreted in pneumonia; the presence and value of the Drazo-reaction in typhoid fever, pulmonary tuberculosis, puerperal conditions and concealed septic processes, the progress of structural diseases of the kidney being marked by the amount of urea present, a diminution, showing non-elimination and consequent absorption.

In the examinations of the sputum, the Lurshman-Leyden spirals in bronchial affections, the Charcol-Leyden crystals in bronchial asthma, the elastic fibres and the tubercle bacillus. The presence of the Klebs-Lœffler bacillus of diphtheria should be demonstrated in every case of that disease, as it will lead to a sharper line being drawn between true diphtheria and these throat affections that simulate the disease. The pneumococcus

of Fraenkel while not yet proven the sole cause of pneumonia is considered by many authorities to bear a casual relation to the disease. Going on to the blood examinations, here the condition, number and relation of the red and white blood corpuscles are the only means by which we can distinguish between chlorisis and anæmia, and anæmia and leukæmia. While Laveran's experiments in 1880, demonstrating the presence in the blood of the plasmodia malariæ, have been corroborated by other investigators in his own country and by many in this, he thus made malaria a definite disease. The Doctor proceeds to speak of the revolution of opinions in regard to the causative factor in typhoid fever. Babes and Brieger are quoted as expressing doubt as to the Eberth bacillus being the sole and only cause. Babes fails to find it in every case, while Brieger claims a mixed infection. Vaughan, of this country, in 1890, made experiments and demonstrated the presence in drinking water obtained from the source of the water supply of a town suffering from a severe epidemic of typhoid fever, of a number of germs capable of producing in rats and guinea pigs the characteristic symptoms of typhoid fever, and invariably fatal. Some of these germs found in the spleen after death, respond to the tests for the Eberth bacillus. Vaughan concludes from this that there are found in certain waters a number of germs capable of producing typhoid fever, and that the Eberth bacillus is an involution form of any one of these. In conclusion the Doctor urges the profession in the report of all cases to add the results of microscopical and chemical analysis of the excretions and secretions indicated.—*Charlotte Medical Journal.*

Liquid **Metal Polish.**—Take 8 ounces of rotten stone, 2 ounces oxalic acid, 3 ounces cotton seed oil and add benzine enough to make the mixture of the required consistency.

EDITORIAL.

Cigarettes.—An analysis at the Department of Agriculture showed : Ash 13.00, water 13.00, ammonia .05, nicotine 1.20, oils and fats 5.00, fiber 6.00, sugar starch 50.00, pretreate matter 12.50. No opium or arsenic was found after analyzing samples of all the common native brands. The opponents should confine their charges to the injurious effect of the nicotine upon the nervous system and upon the heart. It disturbs the regular systole and diastole of the heart and changes the beat to a muffled flutter. After the cerebral exhilaration and exaltation produced by smoking, come with the lapse of hours irritating and debilitating or soporific effects, which give way under the exhilaration of another smoke but persist unpleasantly unless treatment is granted. A body subject to such alternations cannot stand during 25 years what it could have stood if freed from them.

Good Water.—Koch said that water is good unless it contains over 100 microbes to the cubic centimeter. Franland says that there may be many more in good water.

Typhoid Germs.—Dr. Frankland put typhoid germs into deep well water, into Thames water and into Lake Katrine water. The bacilli died more rapidily in Thames water than in the lake water while they persisted longest in the deep well water. The longevity of the germs was proportional to the freedom of the water from other inhabitants.

MICROSCOPICAL APPARATUS.

A New Microscope Lamp.—This excellent lamp, which combines portability with great efficiency, was designed and exhibited at the meeting of the Quekett Microscopical Club, on the 16th of last October, by Mr. W. Goodwin, a member of the club.

The lamp which is nickel-plated, is 2⅛in. in diameter 6½in. in height, and weighs about 3oz. A glance at the

figure shows that it has a metal chimney with two openings : this makes it available for the illumination of two microscopes at the same time. The burner takes a ½in. wick, which yields sufficient light for an amplification of 2,000 diameters when a suitable condenser is used.

The glasses are optically worked, one being tinted steel-blue, the other signal-green ; if, however, untinted light is desired, circles of thin cover glass may be used instead. These, if carefully selected, will stand the heat of the flame without cracking.

The lamp is so small that it can easily be packed in the same case with the microscope, thus dispensing with an
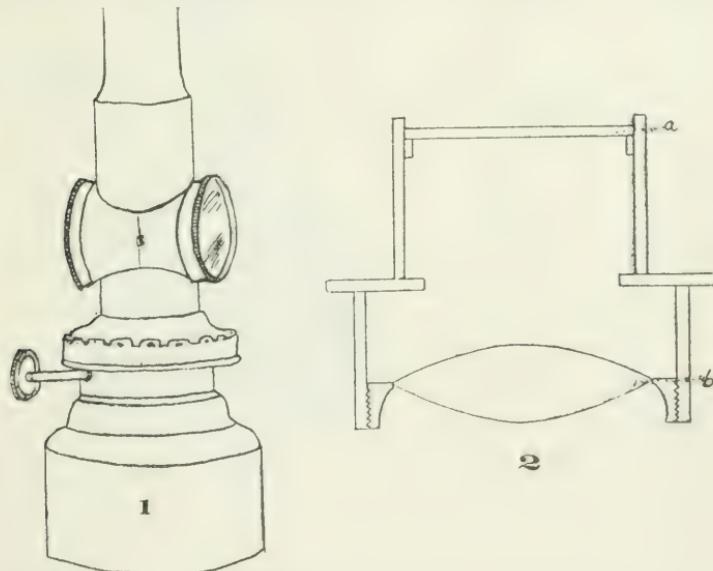
extra box. The price of the lamp is about 12s., and it is made by Mr. H. Hinton, 12 Vorley-road, Upper Holloway, N.—*English Mechanic.*

A Simple Means of Illuminating Objects with Low Powers of Artificial Light.—The following is a simple means of obtaining a pleasant equably lighted field with sufficient intensity and of such a tone as to permit of a prolonged examination of low power specimens without fatigue.

Such an illumination was felt to be a desideratum in quite early microscopical days, and in all the older text-books will be found descriptions of apparatus to serve this end, ranging from simple contrivances like waxed paper, ground glass and plaster-of-Paris mirrors to light modifiers, reflector screens, white-cloud condensers, double parabolic specula, and many more elaborate devices. It is pretty obvious, therefore, that nothing new or striking is likely to be invented for the purpose now, when the tendency is to diminish rather than multiply apparatus.

The idea is to intensify the light and then spread it over a large surface. For the intensification I use the lower, crossed lens of the Abbe condenser, (fig. 2, b) but any suitable fairly large lens of about one inch focus will do as well, either a double convex or the field lens of an eye-piece. This is screwed into the lower end of a piece of tube fitting the sub-stage, or under stage ring, which tube should be a little longer than the focal length of the lens employed. Just below the upper end of the tube is a split ring serving as a ledge, and on this, in the focal plane of the lens, rests a circle of thinnish glass lightly ground on one surface. The light from the flat of the lamp is condensed by the bull's-eye on the mirror, thrown up through the lens and focussed on the ground glass, (fig. 2, a) which is racked or pushed up until almost in contact with the slide. The image of the flame being broken up at every possible angle by the ground glass, with a little manipulation one can fill any sized field with a most pleasant soft light, which can be employed for a long time without detriment to vision. It was long ago discovered, that freshly-ground glass possessed a peculiar property of soft brilliancy which the commercial product did not, and I get circles of the required size from the glass-cutter and grind them myself with a little fine emery and water on another piece of glass until just sufficiently abraded to stop any direct pencils. Besides the ordinary white glass it is a great advantage to get some circles cut from different tints of blue or smoked glass, and either grind these

on one surface in the same way, or temporarily cement them to the unabraded surface of the ground glass, by a drop of cedar oil or glycerine; one thus obtains a series of tones suited to all sorts of objects.—*Journal of Quekett Microscopical Club.—G. C. Karop.*

Formaldehyde Generator.—This apparatus shown in the illustration has been designed by C. Truax, Green and Co., for the safe, convenient and economic production of formaldehyde by the oxydation of methyl alcohol.

Methyl alcohol is made from wood and is much preferred to sulphur for disinfecting purposes. It will penetrate bedding, furniture and clothing, thoroughly disinfecting them without discoloration.

This lamp is convenient, economical and simple in construction, compactly made and requires no fine manipulation to secure the desired result. A room having 2,500 cubic feet capacity may be thoroughly disinfected by this generator without any previous preparation by one filling of the reservoir.

Formaldehyde in its gaseous form has the properties of ready diffusibility and great power of penetration. It may also be used in connection with a sterilizer constructed for the purpose of sterilizing surgical instruments and dressings.—Journal of Am. Med. Association.

A Polarizing Microscope.—Dr. F. C. Van Dyck of Rutger's College described in this Journal in May, 1895, a polarizing microscope which he was using for projection. He has been improving it since that time, till now the results are highly satisfactory. The lantern is a

vertical one, the rays being reflected horizontally by a right-angled prism at the top of the instrument.

Referring to the illustration published in the Journal of May 18, 1895 (p. 154) the general scheme of arrangement is shown. The alum cell is above the second large lens as shown, and the sub-stage condenser is also removed with the 7-8 objective. The analyser swings out from the optical axis, as does also a selenite placed where the sub-stage condenser is shown.

As for its performance, the field on the microscope stage is 1-4 inch; on the screen, 31 feet distant, it is shown just 8 feet in diameter, and as light as the average field of a calcium light stereoptican. With polarized light the structure of granite, pitchstone, Labradorite, and marble were distinctly shown, with the several minerals which were present in them.

The blue and yellow field obtained by using the selenite with open and crossed nicols gave the effects of polarization with much greater distinctness, and added greatly to the beauty of the slide. Some of the specimens so shown were chalcedony, salicine, asparagin, animal and vegetable sections. If a hair, or any dense tissue was present in the preparation, the exact location of such a part was very clearly shown by this combination of selenite and polarizer. Thus the stellate hairs of deutzia, the hairs in the nose of a cat, the cartilaginous portions of a cat's tongue, the difference in composition between the nail and the rhizoid processes forming the "quick;" were all shown far more clearly by this means than by normal light. The medullary rays in trans-sections of woody stems were also polarized, and indicated a beginning of a new field for the application of this light, heretofore regarded as the monoply of the mineralogist and petrologist.

Dr. A. H. Chester has heartily co-operated with Dr. Van Dyck in his work, and they have used their instrument before the Brooklyn and New York Academies of Science recently and received much encouragement and hearty congratulations from other students of physical science.— *Frederick H. Blodgett.*

MICROSCOPICAL MANIPULATION.

Formaldehyde.—Among the newer preparations formaldehyde appears to be meeting many of the claims made for it. It seems to have a wide field of usefulness in several directions: 1. As a food preservative; 2. As a deodorant either in vapor or solution; 3. As a hardening agent in microscopical work; 4. As a preservative of human cadavers; 5. A careful inspection has shown that disinfection by means of formaldehyde vapor is most thorough and complete.

Experiments prove conclusively that formaldehyde as a preservative for mucilage and paste is the ne plus ultra. Before however, this preparation can be used indiscriminately as a preservative for foods and liquors, its nontoxicity must be established beyond the shadow of a doubt. It would seem that this preparation covers a wider field as a preservative than either salicylic acid or borax, and the same care which has been used in testing the physiological effects of these, should be employed with formaldehyde.

Not long ago, when for present lack of time, several specimens of pathological urine could not be examined immediately by a physician, he added two drops of the 40 per cent solution of formaldehyde to each four ounce bottle of the specimens, which expedient answered admirably. Recent experiments in mounting tube-casts, using formaldehyde as a preservative, have proved its efficacy after five weeks. Still these experiments have not continued long enough to guarantee the permanency of the result. Western Druggist.

MEDICAL MICROSCOPY.

Yellow Fever.—There seems no reason to doubt that Giusseppe Sanarelli has discovered the bacillus of yellow fever, as announced some weeks ago. Whether he has discovered a means of curing it, remains to be proved; but the experiment and the result will shortly be pub-

lished.   At Monte Video it is believed that Dr. Sanarelli
has succeeded, and it is believed that he will win the re-
ward of about £30,000 offered by the Brazillian Govern-
ment.   It may be remembered that the enthusiastic Ital-
ian biologist cured himself of yellow fever caught in the
course of his investigations.—Scientific American.

Diagnosis of Pregnancy with the Microscope.   Dr. Park,
of Philadelphia, (Amer. Gyn. and Obstet. Jour.) reports
that after a microscopic study of the triple phosphates in
the urine of pregnant women, he is satisfied that they be-
gan to change their form within twenty days after concep-
tion.   The feathery appearance first disappears from the
tips of the crystals and progresses downward to the base.
Sometimes it occurs only on one side, but generally on
both.   If the fœtus dies they resume their normal appear-
ance again.   The advantage of this means of diagnosis is
that it can be made without the patient's suspecting the
object of the examination, and at a much earlier period
than any reliable physicial sign can be obtained.

Fish Diet and Leprosy.—Dr. Hensen, of Bergen, says:
"I do not think that there is any choice given to the bac-
teria of leprosy as to localization, just as there is none in
the tubercle bacillus.   They develop wherever chance has
deposited them and wherever they find favoring conditions
and no obstacles; for example, on the outside of the arm
where there is little muscular movement.   On the ex-
posed portions of the body, oxygen retains and feeds them.
The inoculation by insects can only be successful in these
places; in others, circumstances are too much against
them.   An internal inoculation is also easily imaginable
and even probable.   Salt fish is eaten all over the world;
raw fish is eaten only in some countries, like Japan.   Fish,
especially the carp, which is so general an alimentation in
Japan, where it is eaten raw and even alive, feed on the
larvæ of mosquitoes, and may be suspected of commun-
icating the spores of disease extracted by the insects from
the exposed parts of diseased bodies.   If not, however,
spores, then the toxins of the bacilli.   In reflecting, then,

upon these points, I should be disposed to conclude that external leprosy inoculation means tubercular leprosy, and internal inoculation anesthetic leprosy."

Medico-legal Importance of the Excrements.—Prof. Moeller has an article in the *Wein. klin. Rundchau* of March 14 calling attention to the value of the testimony afforded in criminal proceedings by microscopic examination of the dejecta. He suggests that criminals arrested on suspicion should be interrogated as to what and where they had eaten recently, and the feces will confirm the truth of their assertions or the reverse, disprove an alibi, etc. He mentions two separate instances where the criminals were traced and brought to justice by casual discovery of fig seeds in their excreta, and adds that the microscope should be used more frequently than at present in criminal proceedings.

BACTERIOLOGY.

The Saliva a Microbe Killer.—It has long been known that secretions of the mucous membranes, especially saliva possess antiseptic properties under certain circumstances, which explains the reason why the germs which enter daily and hourly through the mouth do not reach a harmful development; but Edinger has now found the active material in potassium rhodanate, which is present in saliva. Potassium rhodanate is a compound of sulphur, cyanogen, and potassium, and is in large quantities, narcotically poisonous to warm blooded animals; it is, like other rhodanates fatal to bacilli. It is said that quinolin rhodanate, in a solution of three parts to the thousand, will kill the cholera bacillus in a minute, and in a solution of three times this strength, will kill the diphtheria bacillus in the same time. It was found by further researches that this rhodanate has the effect of carbolic acid and of corrosive sublimate, and at the same time is harmless to man.

Rhodanate is the same thing as sulpho-cyanate, a much better word because it explains itself, and is not liable to be confounded with the derivatives of rhodium.—*Popular Science News.*

Natural and Acquired Immunity.—The natural immunity of certain animals to certain diseases; even when the actual virus is injected, has long been known.   Recently careful investigations have been carried out at the Pasteur Institute at Lille.   In the experiments use was made of the following poisons; an animal virus, serpent's venom, and a vegetable poison (abrine) prepared by macerating jequirity seeds in water.   They found that the immunity of pigs and hedgehogs to venom and of fowls and tortoises to abrine could not be due to the presence of antitoxins in the blood previously to inoculation, for the serum of the normal animals had no protective effect on susceptible animals, nor had it any neutralizing effect on the poison when mixed with it outside the body before inoculation, in both these respects differing from serum containing antitoxins.   They were also unable to discover any antitoxic substance in the brain, liver, spleen, or other organs of the normal animals.   They hold therefore, that the antitoxic serum is independent of immunity, since that may exist when no antitoxic properties are possessed by the serum.   They attribute both kinds of immunity to special characters of the cells of the body.—Lancet.

Bartonology Technique of Obtaining Serum and Dried Blood.—Drs. Hermann Biggs and William H. Park give the following methods for collecting blood to diagnose typhoid fever by the Widal method.   Blood may be easily obtained by pricking the tip of the finger or the ear.   Two or three large drops should be collected on a glass slide and allowed to dry.   Paper is not as good a receiver for the blood as glass, for the blood soaks more or less into it, and later, when it is dissolved, some of the paper fibre is apt to be rubbed off with it.

In preparing the specimen for examination the dried blood is brought into solution by mixing it with about five times the quantity of water.   Then a drop of this decidedly reddish mixture is placed on a cover-glass and to it is added a drop of fifteen-to-twenty-hour bouillon culture of the typhoid bacillus.   The two drops, after being mixed,

should have a faint reddish tinge. The cover-glass, with the mixture on the surface, is inverted over a hollow slide (the edges about the concavity having been smeared with oil or fluid vaseline so as to make a closed chamber), and the hanging drop then examined under the microscope (preferably by gas light), a high-power dry lens (about 1-6 inch) being used.

If the reaction takes place rapidly, the first glance through the microscope reveals the completed reaction, all the bacilli being in loose clumps and nearly or altogether motionless. Between the clumps are clear spaces containing few or no isolated bacilli.

If the reaction is a little less complete, a few bacilli may be found moving slowly between the clumps, in an aimless way, while others attached to the clumps by one end are apparently trying to pull away, much as a fly caught on a fly-paper struggles for freedom.

If the agglutinating substances are still less abundant, the reaction may be watched through the whole course of its development. Immediately after mixing the blood and culture together it will be noticed that many of the bacilli move more slowly than before the addition of the serum. Some of these soon cease all progressive movement and it will be seen that they are gathering together in small groups of two or more, the individual bacilli being still somewhat separated from each other. Gradually they close up the spaces between them and clumps are formed. According to the completness of the reaction, either all the bacilli may finally become clumped and immobilized or only a small portion of them, the rest remaining freely motile, and even those clumped may appear to be struggling for freedom. With blood containing a large amount of the agglutinating substances all gradations in the intensity of the reaction may be observed, from those shown in a marked and immediate reaction to those appearing in a late and indefinite one, by simply varying the proportion of blood added to the culture fluid.

Pseudo Re-actions With Dried Blood. –If too concentrated a solution of dried blood from a healthy person

is employed, there will be an immobilization of the bacilli, but no true clumping. This is sometimes mistaken for a re-action. Again, dissolved blood always shows a varying amount of detritus, partly in the form of fibrinous clumps, and prolonged microscopical examination of the mixture of disolved blood with a culture fluid shows that the bacilli often become entangled in these clumps, and in the course of one-half to one hour very few isolated motile bacteria are seen. The fibrinous clumps, especially if examined with a poor light, may be very easily mistaken for clumps of bacilli. This pseudo-re-action is regarded by many in-experienced observers as a true typhoid re-action, but it occurs as readily with non-typhoid as with typhoid blood.

Prof. L. H. Pammel, Ames, Iowa.

MICROSCOPICAL SOCIETIES.

New Jersey State Microscopical Society.

April 26.—The 28th Anniversary of this society was celebrated at New Brunswick, N. J., by the most success-ful soiree yet held. There were fifty-seven exhibits under microscopes and on tables, and a demonstration of rock sections by polarized light as a preliminary.—*F. H. Blodgett, Secretary.*

The American Microscopical Society.

The next meeting of the American Microscopical Society will be held at Toledo on Thursday, Friday and Saturday, August 5, 6 and 7. The Toledo Microscopical Society have very cordially invited their brethren from other parts of the country to pay them a visit and have promised to do all in their power to render that visit entertaining and instructive.

Those who attended the gathering at Pittsburg last year will recall the welcome tendered and the interest mani-fested by the members and their friends in the Iron City and we trust that all who can do so will renew the exper-ince by coming to Toledo in 1897.

The officers for the Toledo meeting are as follows: President, Prof. E. W. Claypole, B. A., D. Sc. (Lond.) F. G. S., Buchtel College, Akron, O.; Vice-President, C. C. Mellor, Pittsburgh, Pa.; Secretary, William C. Krauss, M. D., Buffalo, N. Y.; Treasurer, Magnus Pflaum, Pittsburgh, Pa.; Executive Committee, A. A. Young, M. D., Newark, N. Y., Mrs. S. P. Gage, Ithaca, N. Y., W. P. Manton, M. D., Detroit, Mich.

The purpose for which the Society exists are the following:

1.—To give to all who are interested in the use of the Microscope an opportunity of seeing what others are doing and of showing to others what they are doing themselves. In this way time is saved by avoiding useless experiments and labor directed into profitable channels. Moreover workers are often enabled to give one another mutual assitance by becoming acquainted with the fields in which their fellows are engaged.

2.—To afford an opportunity for personal acquaintance and intercourse with other microscopists and thus lessen the sense of isolation which the great size of the country and the fewness of the workers inevitably produces. Acquaintances thus begun at the meetings often ripen into life-long friendships based on mutual esteem and appreciation.

3.—To afford to a Microscopist working under difficulties in a country district or in a small educational institution an opportunity of seeing the more costly and complicated pieces of apparatus only to be found in the hands of dealers, professors teaching in large or wealthy colleges or specialists in the great cities.

4.—To advance the cause of microscopic study among the people living in the district where the meeting is held by showing the interest felt in the work outside of their own limits. For this reason the Society assembles at a different place every year.

The American Microscopical Society is national in extent and welcomes to membership all who are sufficiently interested in actual microscopical work or in the results

of that work to enlist in its ranks. No other stipulation is made. It is a band of workers interested in each other's pursuits and willing to give and take whatever aid their union can supply. They do not set themselves on a pinnacle as experts and specialists but claim to be merely a small company working for the general good and well aware that the humblest observer may be able to add knowledge and experience that will be of value to all. The yearly subscription to the A. M. S. is two dollars with an entrance fee of three dollars. In return for that the members receive free a copy of the published papers of the Society.

Quekett Microscopical Club.—Mr. W. Stokes gave a description of some easily-made monochromatic light filters for microscopical purposes. The subject was further discussed by Mr. Nelson, Mr. Rheinberg, and others. Mr. T. Rosseter read a paper "Experimental Infection of the Domestic Duck with Cysticerci or Larval Tapeworms." Specimens and drawings were shown, by the author, of Dicranotænia coronula and Cysticercus coronula, Drepanidotænia gracilis and Cysticercus gracilis, D. tenuirostris and Cysticercus tenuirostris, in which cases he had proved by direct experiment that the given Cysticerci were really the larval forms of the tapeworms specified, and the matter was now no longer one of mere surmise from the identity of the hooklets, &c. The secretary said Mr. Rosseter appeared to be the sole investigator of the life history of this interesting group of bird parasites in this country.

Mr. Nelson exhibited a new triplet magnifier he had computed with a working distance of 8–10 in., a new achromatic and aplanatic bull's-eye, and read a paper on the secondary structure of the diatom, Kittonia elaborata.

In consequence of April 16th being Good Friday, the next ordinary meeting will be held on Friday, May 21st.

The College of Physicians and Surgeons, of Chicago, has recently become the Medical School of the University of Illinois.

SCALES OF FISHES.
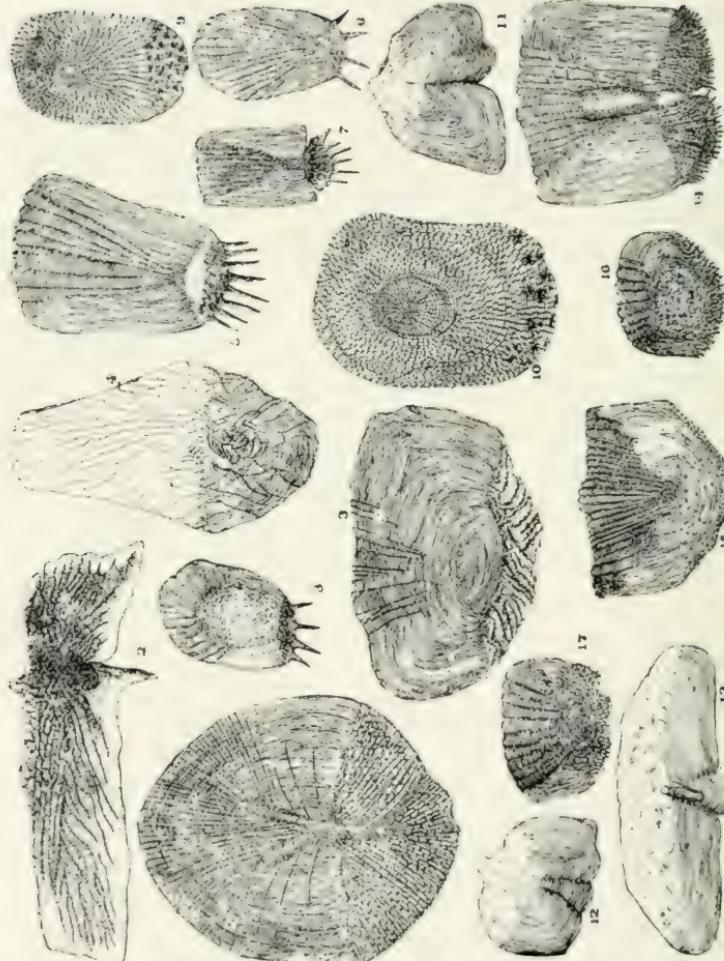
1. German Carp. (lateral).
2. Stickleback.
3. Bluefish.
4. Herring.
5. Sole.
6. English Sole.
7. English Sole.
8. English Sole.
9. Tom-cod.
10. Tom-cod.
11. Minnow.
12. Minnow.
13. Minnow. (lateral).
14. Perch. (lateral).
15. Cod (?).
16. Opal.
17. Opal.

Notes on Some New, or Presumably New, Infusoria.

By J. C. SMITH,

NEW ORLEANS, LA.

(Continued from Page 117 of last Month's Journal.)

Family.—Anisonemidæ. S. K.
Genus.—Entosiphon. Stien.
Species.—Entosiphon emarginata. (fig. 12.)

Body subobovate; less than twice as long as wide; anterior extremity slightly emarginate and flexed towards the ventrum; posterior extremity obtusely pointed; the right hand half of the anterior border slightly concave; dorsum convex and smooth; ventrum plane; oval aperture at apex of anterior emargination; pharyngeal tube extending in a median line from the oval aperture through two thirds of the body length; flagella originating together and to the right of the oval aperture; the anterior one equal to one body length and the posterior one to two body lengths; contractile vesicle conspicuous and located in the anterior half just below the dextral concavity; nucleus round and subcentral; endoplasm bluish and granular in posterior body half; locomotion as Entosiphon sulcatus. Duj. Size 1-1833 inch. Habitat—Pond water with algæ. Longitudinal fission.

This minute specimen of the genus resembles very much in outline the Anisonema pusilla of Dr. Stokes, but the resemblance goes no further. The pharyngeal tube is protusile and this is made very apparent when the

infusorian is pressing up against debris, in the act of feeding. The movement of the body during natation is the same smooth even glide of the genus. This form has been found quite abundant at times and but once has reproduction been observed—the process occupying about one hour.

Family.—Enchelyidæ. S. K.
Genus.—Enchelys. Ehr.
Species.—Enchelys audobonii. (fig. 13.)

Body obovate, the anterior border produced in a snout-like manner, subcylindrical, soft and changeable in shape more than twice as long as wide; entirely and sparingly ciliate; oral aperture apical, cleft-like and continued medicosely for about one-sixth of the body length, as a conspicuous, non-plicate, wedge-shaped membraneous pharynx; oral cilia much longer, heavier and more numerous than the body cilia; a single hair-like seta extending from the posterior border as long as one-half the body length; contractile vesicle round, conspicuous and located in posterior third, nucleus round and subcentral; endoplasm granular and of a greenish tint, usually containing food balls. Reproduction by transverse fission; conjugation by the application of the oral apertures. Locomotion rapid and by revolution on long axis. Size 1-600 to 1-460 inch. Habitat—Pond water with decayed leaves from Audobon Park, New Orleans, La.

This infusorian was found in great abundance a number of times in pond water taken from Audobon Park. While the most persistent shape is obovate it is, like Enchelys farcimen Ehr., subject to many changes of form from an ovate to almost globular. The oral aperture forms the base of the wedge-shape pharynx and is persistently open. It is a greedy scavenger. The writer has a number of times observed a dozen or more surrounding some dead form ravenously devouring it. The elas-

ticity and capaciousness of the oral aperture and pharynx has been often demonstrated by the engulphing of particles of food twice the size of the infusorian. The caudal seta is difficult to see excepting when the infusorian is quiet.

Family.—Prorodontidæ. S. K.
Genus.—Holophrya. Ehr.
Species.—Holophrya pogonias. (fig. 14.)

Body ovate, subcylindrical, exceedingly elastic and changeable in shape; twice as long as wide; posterior evenly rounded, anterior transversely truncate and including oval aperture; body entirely and finely ciliate; coarsely striated longitudinally; oral and body cilia not diverse; a supplementary fasicle of extra-oral cilia situated just below the oral aperture; these cilia much heavier (not setose) and about three times longer than the body cilia; projecting upwards and some distance above the oral aperture; contractile vesicle round, conspicuous and centrally located; nucleus botuliform and placed longitudinally alongside the contractile vesicle; endoplasm granular, of a yellowish tint and usually containing large food balls; locomotion in a wabbling manner by revolution on long axis. Size 1-150 inch. Habitat—Brackish water from Lake Pontchartrain.

The writer has some doubts as to the position of this form and has placed it among the Prorodontidæ provisionally. In its habits and general appearance it resembles the Holophrya, but the presence of the extra-oral cilia may prevent its being placed among this family.

Family.—Colpidæ. Ehr.
Genus.—Coleps. Stien.
Species.—Coleps striata. (fig. 15.)

Body subovate, cylindrical, slightly elastic but persistent in shape; less than twice as long as wide; anterior

transversely truncate and including oral aperture; pos-
terior evenly rounded; heavily striate longitudinally; the
spaces intervening finely and closely striate transversely
oral cilia longer than body cilia, but not setose; contrac-
tile vesicle large and postero-terminal; nucleus roundish
and sub-central; oval aperture to one side and just above
the contractile vesicle; endoplasm granular; locomotion
even and by revolution on long axis. Size 1-500 inch.
Habitat—Fountain water with aquatic plants.

This form would, if it possessed the setose oral cilia
certainly be classed as a Plagiapogon-Ehrenberg. The
very heavy longitudinal striation, which are almost band
like in this new form, and the fine transverse striation of
the intervening spaces are also characteristic of the genus
Plagiapogon. In its habits it is the same scavenger that
the Coleps hirtus is.

Family.—Lembidæ. S. K.
Genus.—Lembus. Colin.
Species.—Lembus attenuata. (fig. 16.)

Body elongate, subcylindrical; elastic but persistent in
shape: about six times as long as widest part; widest at
the center and tapering to both extremities; anterior
transversely truncate; posterior ending in a sharp point,
an undulating membrane and a furrow commencing just
behind the anterior border and extending backward to
the oral aperture, which is situated at the junction of
the first and second body fourths; body sparingly clothed
with cilia and these cilia as long as the widest central
part of the body; oral cilia same size as body cilia but
more numerous; undulating membrane capacious and
extending as far out as distal ends of oral cilia; contrac-
tile vesicle conspicuous and situated centrally near the
ventrum; endoplasm bluish and semi-opaque, locomotion
vermicular.

Size 1-325 inch. Habitat—Stale pond water.

So far as the writer knows this is the first fresh-water member of the family recorded.

Family.—Dysteriidæ. S. K.
Genus.—Trochilia, Dujardin.
Species.—Trochilia fluviatilis. (fig. 17.)

Body subelliptical; almost twice as long as wide; carapace single, dorsum broadly convex; anterior obliquely truncate to ventrum, posterior rounded; ventrum plane and clothed with fine short cilia; a movable stylate appendage originating in the posterior third of the ventrum and projecting to a short distance beyond the posterior border; projecting from, and within the anterior truncation, are numerous fine vibratile cilia; this truncation also includes the oral aperture and proceeding backward from this aperture is a tubular pharynx which continues directly upwards, through three fourths of the body length; this pharynx is protusile; contractile vesicles, three, two located in the anterior body half, above the pharynx and near the dorsum and one in the posterior body half below the pharynx and near the ventrum; nucleus not observed,—obscure ; endoplsam, bluish and very often vacuolar, size 1-850 inch. Habitat, Pond water with aquatic plants, ponds connected with the Mississippi river.

For one month the writer got a number of dips from a pond in Audobon Park, New Orleans, and in almost every one of the numerous examinations made of this water, were found an abundance of this form. They move about and through debris piles very much as an Aspidisca. In no single instance, when they were examined closely and measured, was there the slightest difference in shape or size. While the truncated anterior was pressed against a heap the tubular pharynx could be seen distinctly to move forwards, as is observed in the case of Entosiphon sulcatus, Duj. Unfortunately the

nucleus could not be observed even after the most careful search and the application of the usual reagents. In some samples examined all the forms under the cover glass were densely vacuolated.

Family.—Onytrichidæ. S. K.
Genus.—Stichotricha. Perty.
Species.—Stichotricha opisthotonoides. (fig. 18.)

Body elongate; somewhat club shaped, the anterior two thirds attenuate, three times as long as the widest part; highly elastic but persistent in shape; addicted to curving backwards; peristome channel-like and extending from the apex to the posterior body third and there curved towards the left hand body border, the peristome cilia long and heavy diminishing in size as they approach the oral aperture; the left hand border of the peristome finely ciliated and bearing a conspicuous undulating membrane, marginal setæ on the anterior half of the sinistral border and on the posterior border; two oblique rows of small ventral setæ extending from the sinistral to posterior setæ; contractile vesicle conspicuous, located in the posterior third and in contact with the left hand border which it extends at each expansion; nucleus, two, ovate and situated one in each body half; locomotion eccentric. Size 1-450 inch.

Habitat—Old infusion of aquatic plants in ditch water.

The writer had under observation quite a large number of this new form and they were all addicted to the habit of bending the anterior attenuate body half backwards as if in great pain; it was this peculiar habit that suggested its specific name. While in this act the undulating membrane is thrown out from the body border to a considerable distance. The writer has never seen recorded that any of this genus possessed an undulating membrane and believes this species stands alone in this

respect.   The Stichotricha secunda—Perty, and Stichot-
richa aculeata—Wrz, are often seen in the pond waters
in New Orleans and bear only a superficial resem blance
to this form.

Family.—Oxytrichidæ. S. K.
Genus.—Oxytricha. Ehr.
Species.—Oxytricha furcatus. (fig. 19.)

Body elliptical, both extremities evenly rounded; very
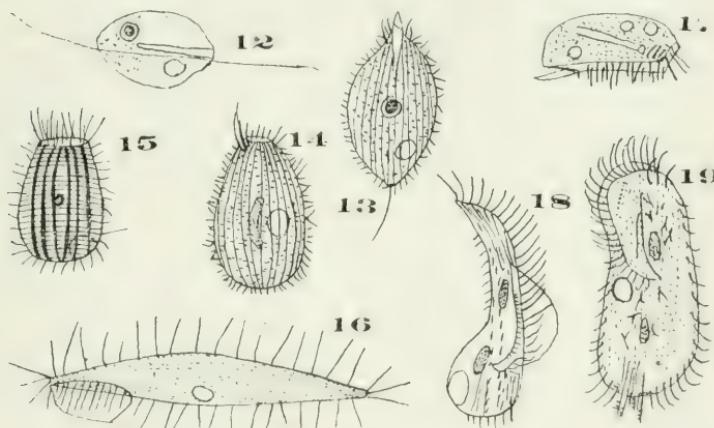
12.—Entosiphon emarginata. x 1300.
13.—Enchelys audobonii. x 500.
14.—Holophrya pogonias. x 150.
15.—Coleps striata. x 375.
16.—Lembus attenuata. x 730.
17.—Trochilia fluviatilis. x 740.
18.—Stichotricha opisthotonoides   x ʹ75.
19.—Orytricha furcatas. x 225.

soft and flexible, less than two and a half times as long
as wide; the left hand border slightly concave anteriorly
lip crescentic and conspicuous; peristome extending to
centre of body and strongly curved to oral aperture; the
right hand border of peristome bearing an undulating
membrane; frontal styles, eight and arranged as on Sty-
tonychia mytilus, Ehr.; the three most anterior uncinate,
and the remaining five furcated; ventral series arranged
as on Stytonychia mytilus, Ehr., and all furcated; anal

styles, five, fimbriated at their distal ends and all, but the one nearest the left hand body border; projecting beyond the posterior marginal setæ continuous, heavier and longer posteriorly; contractile vesicle located at the centre of the left hand body border; nucleus, two, elongate, one in each body half.   Size from 1-200 to 1-150 inch.   Habitat—Old infusion of rose fission petals. Transverse.

This form was found exceedingly abundant in an old infusion of rose petals, feeding ravenously on the very abundant bacteria.   Many of them seemed so gorged with food that they moved about very lazily, affording the writer a good opportunity for their observation. The fine inferior frontal stylesand all of the ventral series were invariably furcated to within almost their origin; bifurcated usually, a few specimens distinctly tri-furcated.   In a few specimens the three superior of the frontal series were bifurcated and in some rare instances an odd one or two of the marginal series were bifurcated.   The distal ends of all of the anal series, for about one fifth of their length, were distinctly and uniformally fimbriated.

Supplementary Note Upon Actinomonas Primus.

An infusorian somewhat similar to this form is described by Dr. Gruber under the title of Dimorpha mutans.* In its flagellate condition, the D. mutans resembles a Heteromita, having an anterior vibratile and a posterior trailing flagella.   In its Heliozoan state the pseudopodal rays equal from two to three diamaters of the zooid and decussate.

ERRATA : Wherever the word "Ventrum" appears read "Ventral Surface."

In family Anisomidæ, Species Diplomastix rostrum, read "rostratus" for rostrum.

In family Anisomidæ, Specie Entosiphon emarginata, reverse the figure, making the right hand border the left hand.   Contractile Vesicle following the change; the figure should be turned over.   In the diagonosis of this Species where the word right or dextral appears read "left" or "Sinistral."

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*Appendix to vol. II Kent's Manual of the Infusoria.

Preparation of Culture Media with Special Reference to Sterilization.

BY RAYMOND C. REED, Ph. B.

[Assistant in the Department of Comparative Pathology and Bacteriology, New York State Veterinary College, Cornell University, Ithaca, N. Y.]

The amount of culture media used by the students in a bacteriological laboratory is so great that its preparation after the method given in the text books occupies an undue proportion of the time allotted to this subject. If it is prepared by an assistant and furnished to the students it not only takes much of his time, but it deprives the student of the opportunity of learning one of the most important processes necessary for successful work in bacteriology. Hence any change which will shorten the time required for its preparation will be of value. When it is prepared by the usual method recommended in text books on Bacteriology at least three days are necessary to complete the process of sterilization. The method of sterilizing by which the media is heated to a somewhat higher temperature than 100° C. by means of superheated steam is open to the objection that the nutritive properties are impaired to a greater or less extent for certain species of bacteria.

In 1890 Moore* published a paper giving the method employed in the Bureau of Animal Industry for making nutritive agar and which seems to be the one recommended, with slight variations as to details, in the greater number of bacteriologies. The two most important changes suggested were, (1) that when the agar was made from meat infusion instead of meat extract, it should be prepared from bouillon which could be made up in quantities and kept stored in flasks as stock ready for use. This applies not only to the making of agar but also gelatin

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*The Preparation of Nutritive Agar. By V. A. Moore, M. D., American Microscopical Journal, May, 1890.

or any other medium which requires a meat infusion for
its nutritive base. (2) That the agar should be cut up in
small pieces and dissolved in a liquid which contains no
coagulable material before it is added to the bouillon.
This is done by using the proportion of five grams of
agar, finely chopped, to 100 c. c. of water and boiling in
an agate iron dish over a direct flame with constant stir-
ring. I have found, however, that it is more satisfactory
to boil the agar in a closed water bath. This takes not
to exceed twenty minutes longer and as there is no dan-
ger of the agar burning the stirring and constant atten-
tion required when it is dissolved over a flame is unnec-
essary. By this method the agar is completely dissolved
and a medium of a known consistency can always be made.

In 1892 Schultz,* of the Johns Hopkins Hospital, de-
scribed a rapid method of making agar which requires
but one hour for the whole process. For this he uses
meat extract which gives a medium favorable for the
growth of some organisms but not for others. He also
gives a method by which the agar may be made from
meat infusion taking but an hour and a half.

The following method of preparing media has proved
very satisfactory and in my hands more so than the one
described by Schultz although his process has many ad-
vantages.

The preparation of peptonized bouillon.—To 1000 grams
of finely chopped or ground meat (beef or veal) add 2000
c. c. of distilled water. Put in an agate iron dish and
heat in a water bath at a temperature of from 60° to 65°
C for two hours or allow it to macerate in a cool place
for 24 hours. Strain through a coarse cloth and bring
the amount of liquid up to 2000 c. c. by adding water if
necessary. To this infusion add $\frac{1}{2}$ per cent peptone and

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*A Rapid Method of Making Agar-agar. By John L. Schultz. John's
Hopkins Hospital Bulletin, No. 24, July—Aug., 1892.

½ per cent sodium chloride and if a neutral or alkaline medium is desired add enough of a 1 per cent solution of caustic soda to bring about the required reaction. Boil in a water bath for half an hour. Cool and filter through ordinary filter paper and distribute in sterilized flasks. The amount in each flask is to be determined by the work in the laboratory. I have found 500 c. c. a convenient quantity.

Preparation of nutrient agar. —Dissolve 5 grams of finely cut agar in about 100 c. c. of water. This may be done in either of two ways, by heating over a direct flame for about ten minutes with constant stirring to prevent burning or by heating in a closed water bath until the whole mass becomes gelatinous. The agar is then added to 500 c. c. of bouillon, thoroughly mixed with it and boiled in a water bath for twenty minutes. It is then cooled down to 45° to 50° C. and the whites of two eggs added and thoroughly mixed with the agar. It is then returned to the water bath and boiled for from twenty to thirty minutes. The albumen will then be collected in a firm coagulum containing any insoluble particles that may have been in the agar, leaving a perfectly clear liquid. It is filtered while hot through ordinary filter paper, the filtration taking place rapidly without the aid of a hot filtering apparatus. The filtrate is then distributed in tubes which have been previously plugged with absorbent cotton and sterilized.

Preparation of nutrient gelatin—To 500 c. c. of bouillon add 50 grams of gelatin and heat in a water bath until the gelatin is dissolved. Cool to about 45° C. and and the whites of two eggs, mix thoroughly. This is done most rapidly and effectually by pouring the liquid several times from one dish to another. Then boil in a water bath for twenty minutes. Filter through ordinary filter paper and distribute in sterilized tubes. Care

must be taken not to boil gelatin too long or it will lose
its property of solidifying when cold.

Sterilization of Media. It will be seen that the pro-
cess of preparing culture media up to the point of steril-
ization is practically the same as that described in recent
text books on bacteriology. The method is short and by
having the nutritive medium prepared and kept in stock
the preparation up to this point of either agar or gelatin
is very simple. The essential time consuming part of
the process is the sterilization. Although this has now
been reduced from the boiling on six consecutive days to
three, it is still an important element in laboratory work
especially where students are present but two or three
days, usually alternating, in each week.

During the past two terms I have made a considerable
number of experiments for the purpose of determining
if it is necessary in order to secure complete sterilization
to boil media, when distributed in small quantities in
tubes, for three consecutive days. In these experiments
I have found that one boiling for a slightly longer time,
thirty minutes, seems to be all that is necessary to ster-
ilize bouillon, nutrient agar and nutrient gelatin distrib-
uted in either small or large tubes. After distributing
the medium the tubes were put in a closed water bath
and boiled vigorously for thirty minutes. At the expir-
ation of that time they were taken out and placed in an
incubator where they were allowed to remain for several
days, when it was a simple matter to sort out and reject
any tubes that may have been contaminated. As will
be seen from the appended tables, giving the results of
these experiments, contaminations have been very rare.
In fact they have not been much if any more numerous
than they were when the three regular boilings were em-
ployed. Although several of the agar and gelatin tubes
were not sterilized, they were contaminated with a spore

bearing bacillus which has not infrequently appeared in
media boiled for ten minutes on three consecutive days.

STERILIZATION OF BOUILLON WITH ONE BOILING.

Date.	Number of tubes.	Amount in each tube.	Time boiled.	Days in incubator after boiling.	No. of tubes contaminated	Remarks
Jan. 9, 1897	40	7 c. c.	30 min......	7	0	....
Jan. 14, 1897	80	7 c. c. ...	30 min......	7	0	..............................;.....
Jan. 14, 1897	14	25 c. c.	30 min......	7	0	Fermentation tubes with one per cent. glucose.
Feb. 5, 1897	32	7 c. c........	30 min......	7	0	....
Feb. 11, 1897	35	7 c. c	30 min......	6	0	....
Mar. 5, 1897	46	7 c. c........	30 min......	7	0	....
Apr. 6, 1897	45	7 c. c	30 min......	5	0	....

STERILIZATION OF AGAR WITH ONE BOILING.

Date.	Number of tubes.	Amount in each tube.	Time boiled.	Days in incubator after boiling.	No. of tubes contaminated.	Remarks.
Jan. 22, 1897	50	7 c. c	30 min......	7	3	Each of the three tubes contained a spore bearing bacillus belonging to the *B. subtilis* group.
Jan. 27, 1897	48	7 c. c ...	30 min......	7	2	Same as above.
Feb. 5, 1897	81	7 c. c........	30 min......	6	0	....
Feb. 13, 1897	14	7 c. c........	30 min......	7	0	....
Mar. 16, 1897	25	7 c. c........	30 min......	7	0	....
Mar. 27, 1897	41	7 c. c........	30 min......	7	0	....
Apr. 6, 1897	40	7 c. c........	30 min......	7	0	....

STERILIZATION OF TUBES OF AGAR CONTAINING A LARGER QUANTITY FOR MAKING PLATE CULTURES.

Date.	Number of tubes.	Amount in each tube.	Time boiled.	Days in incubator after boiling.	No. of tubes contaminated.	Remarks.
Dec. 29, 1896	30	12 c. c........	30 min......		0	Left at room temp. for 10 days
Jan. 27, 1897	26	15 c. c........	30 min......	7	0	....
Feb. 5, 1897	15	15 c. c........	40 min......	6	0	....
Mar. 16, 1897	35	18 c. c........	30 min......	7	0	....
Mar. 27, 1897	43	18 c. c.......	30 min......	7	3	Spore bearing bacillus belonging to the *B. subtilis* group.
Apr. 6, 1897	40	18 c c........	30 min....	7		....

STERILIZATION OF GELATIN WITH ONE BOILING.

Date.	Number of tubes.	Amount in each tube.	Time boiled.	Days in incubator after boiling	No. of tubes contaminated.	Remarks.
Dec. 29, 1896	30	12 c. c.....	30 min....		0	Left at room temp for 14 days
Feb. 19, 1897	30	15 c. c.....	30 min....	7	0	....
Mar. 18, 1897	15	18 c. c	30 min....	7	0	....
Do............	25	7 c. c.....	30 min....	7	1	Contained a spore bearing bacillus belonging to the *B. subtilis* group.
Mar. 23. 1897	10	18 c. c	30 min....	7	0	....
Do............	36	7 c. c.....	30 min....	7	0	....
Mar. 25, 1897	35	7 c. c	30 min....	7	0	....

If spore bearing bacilli are present in large numbers more difficulties might be experienced. But ordinarily if the medium is prepared with proper care and distributed as soon as filtered, in sterile tubes and boiled at once very few contaminations are likely to occur.

The time that must elaspe before the medium can be safely used is not so much shorter than when the customary method is employed but the time actually spent in sterilizing is much shorter. In a crowded laboratory this is important. It probably is not necessary to leave the media in the incubator from five to seven days as I have indicated in the above tables for in every case of contamination the growth took place within the first twenty four hours.

I am not prepared to say that this method is the best or that it is safe for all kinds of work, but it has proved to be well adapted to the needs in a student laboratory and to save much valuable time for both the student and the teacher.

Prof. Hankine, one of the leaders in sanitary work in India, contracted plague a few weeks ago, but fortunately the attack was not severe and he recovered. He was inoculated with Haffkine's serum.

The Index of Refraction.

By Dr. B. L. RAWLINS,

DALLAS, TEXAS.

A ready, fairly accurate and practical method of determining the index of refraction of liquids, and transparent solids with plane parallel sides, would be of interest possibly to the majority of workers.

The works on optics and the elementary treatises on how to work with the microscope, apparently lose sight of the necessity for something practical, in giving us complicated formulas and describing expensive instruments for determining this index.

It is with this apology that the writer offers this article, feeling sure that the same thing must have occurred to many, although he has never seen this method published.

As in passing from a rarer to a denser medium, a ray of light is deflected in a definite direction from its immergent course, likewise is the apparent distance through the denser medium less than the real distance.

As the ratio of the sin. of the angle of incidence to the sin. of the angle of refraction is constant, likewise is the ratio of the apparent distance through the denser medium to its real distance invariable.

From experiment it is found that as many times greater than the sin. of the angle of refraction is the sin. of the angle of incidence, so many times greater is the real distance through the denser medium, than the apparent distance.

For example the angle of refraction of water is 1.333: the apparent depth of a volume of water one and one-third feet in actual depth, is one foot.

Assuming that the worker interested in this subject is possessed of a microscope with accurate adjustment and a graduated micro-millimeter fine adjustment screw, he

needs but a slide with a flat cell cemented on it, and a plate cover glass in order to do the work. Perhaps the most convenient thing is the slide that goes with the Zeiss–Thoma blood counter. This has a circular cell cemented onto the slip, with a central cross lined disc, which forms an elevated platform in the centre of the cell, leaving a groove to catch any excecs of liquid, in order that it may not flow between the top of the cell and cover glass.

In making the examination, the rules accompanying this instrument must be strictly regarded, in order to insure direct contact with the cover and top of cell. That is, when a minute drop has been placed on the platform and covered with the accompanying plate glass cover, the newtonian rings must appear, otherwise a bit of dust or something has prevented perfect contact between cell and cover. The depth of the cell in this instrument is convenient for calculations, as it is exactly 10 microns.

Procedure. Dust carefully the cell and cover glass with a soft lens brush. After putting the slip on the stage of the microscope (under a 1-5 or D objective for convenience in accurate focussing) the cover is put in place with a pair of forceps, pressed down centrally with the ball of the finger. The finger print made is of the greatest use. If the Newtonian rings are apparent, allis well; if not, try again. Turning the zero mark on the m. m. fine adjustment screw to the pointer, focus to the top of cover glass with coarse adjustment. A little patience allows one to do this, and it is much more convenient. This done, focus with the fine adjustment, noting the distance on the m. m. scale, until the top of the cross lines of the counter are in perfect focus. This distance represents the depth of cell, plus cover glass equal m. Removing the cover and pressing between the fingers, focussing on top and on bottom gives apparent (which is all required,) thickness of cover equal n.

The difference, m minus n equals a and equals depth of cell filled with air.

In like manner a drop of the liquid whose index of refraction is to be determined, is placed in the cell and the cover applied as before and pressed down with the finger. Let us suppose it is water, and that the equation for air substituted is 30 microns minus 20 microns equal 10 microns, or the depth of the cell filled with air.   A equals 10 microns.

Now, m minus n equals b and equals depth of cell filled with water.   Substituted we have 27.5 microns minus 7.5 microns.   B equals 7.5 microns.   A divided by b equals 10 divided by 7.5 which equals 1.333 the index of refraction of water.

For obtaining the index of transparent solids with plain sides, as for instance of cover glasses or slips, the apparent depth is obtained as before, the real thickness measured with the cover glass guage or calipers.   Their ratio is the index.

It is not within the province of this article to suggest the important or varied applications attendant on the determination of this index, but the writer will feel highly repaid if it is of interest to any of the readers of the Journal.

EDITORIAL.

Prof. Edson S. Bastin.—The death of Prof. Edson S. Bastin means a severe loss to the body of American scientists.   He was one of the most faithful workers in pharmacy.   For the last two years he has devoted himself so unceasingly to microscopical work outside of the hours devoted to instruction, that he has virtually allowed himself no proper time for rest, and as a matter of fact, has almost worked himself to death.   His work on the anatomy of plants of the pine family has been recognized as of great importance here and abroad.

Inks.—Dr. Marpmann of Leipzig, has recently published the results of the microscopical examination of 67 samples of ink used in schools. Most of these inks were made with gall-nuts, and contained saprophytes, bacteria and micrococci. Nigrosin ink, taken from a freshly opened bottle, was found to contain both saprophytes and bacteria. Red and blue inks also yielded numerous bacteria. In two instances Dr. Marpmann succeeded in cultivating from nigrosin ink a bacillus which proved fatal to mice within four days. This ink had stood in an open bottle for three months, and the inference drawn from the inquiry is that ink used in schools should be kept covered when not in use.

A Water Microbe.—One of the unaccountable phenomena of the Black Sea has been explained by the bacteriologists. Since time out of memory it has been a well-known fact that there were no deep-sea fish in the body of water mentioned. Away back in 1850 the scientists made an investigation and found that fish could not live at a greater depth than 200 fathoms in the water of the Black Sea on account of the presence of a superabundance of sulphuretted hydrogen. Time and again the waters were stocked with deep sea fish, but all died on account of the poisonous gas which was generated in such quantities in those portions of the water which should have been their natural habitat. It was known that the gas was at the bottom of all the trouble, but exactly where the gas came from was what so puzzled the investigators. The microbiologists finally took the matter in hand and a recent observer now announces that the gas is generated by the countless number of microbes which make their home in the ooze at the bottom. This microbe decomposes mineral sulphates and has been named Bacillus hydrosulfuricus ponticus.

One more indictment is added to the many against the house-fly. Yersin communicated plague to guinea-pigs by the inoculation of sterilized water in which flies found dead in the laboratory had been rubbed up.

MICROSCOPICAL MANIPULATION.

A New Culture Medium for the Diphtheria Bacillus.—
Joos (Jour. Med. de Bruxelles, May 7, 1896) has had occasion to make a large number of bacteriological examinations in cases of suspected diphtheria. He finds that the ordinary methods of cultivating Loffler's bacillus are not satisfactory; he also finds Deycke's method unsatisfactory, as it hinders the growth of the Loffler bacillus, and stunts the colonies. Joos has modified Deycke's medium, and claims to have found a material on which no other bacillus except that of diphtheria will grow normally. He prepares "albuminate of soda" by adding saturated caustic soda solution to serum of strong alkalinity, placing the mixture in a vapor bath for half an hour, and filtering. To the filtrate is added pure hydrochloric acid till the reaction is neutral or very slightly alkaline. If too much caustic soda was not added at first, the substance is now ready for use; otherwise the excess of sodium chlorid requires to be dialyzed out. On evaporating to dryness, a powder is obtained which is readily soluble in water, and which is not coagulated by heat. The nutritive medium is prepared by adding to 1000 gr. of peptonized bouillon 20 gr. each of agar and "albuminate of soda." The mixture is placed in the autoclave at a temperature of 115 degrees to 120 degrees C. for half an hour; then 15 c.cm. of caustic soda are added, and the whole put back in the autoclave for fifteen minutes, after which it is filtered in the vapor bath. After filtration, it is sterilized at 120 degrees C. in the autoclave for three quarters of an hour, when it is ready for the preparation of the plates. It is claimed by Joos that streptococci will not grow on this medium at all, and staphylococci but feebly, while Loffler's bacillus grows luxuriantly in from six to twelve hours. If the presence of streptococci is to be determined as well, the amount of "albuminate" is to be reduced to one and one-half per cent. At the end of fifteen to eighteen hours small colonies of streptococci may be seen among the large and well-developed patches produced by the diphtheria bacillus.

Preservation of Urinary Deposits.—Heretofore the subject of mounting and preserving urinary deposits has received comparatively little attention, perhaps from the fact that no suitable method has been discovered. Specimens of urinary deposits, when properly mounted, are an excellent means of demonstrating the various pathological elements found in urine. We are indebted to Gumprecht (Centralblatt f. Inn. Med.; British Medical Journal, September, 1896) for the following method, which he finds to be superior to chloroform or glycerin: A deposit is first obtained by means of the centrifuge. This deposit is then placed in a concentrated solution of corrosive sublimate and centrifugalized again. It is then washed, and preserved in a solution of formal. The hardening in sublimate may be omitted if no red blood-cells are present. If there is much albumin present, the deposit may be washed with advantage in a normal saline solution. If the urine contains urates, the deposit should be washed with warm water or a concentrated boracic solution. The washing of a deposit by means of the centrifugal machine has long been in use in the laboratory. No washing is necessary if sublimate is not used. The strength of the formal solution may vary from two to ten per cent. The author says that urinary deposits thus preseved can hardly be distinguished from fresh deposits. Cover-glass preparations may be made, but it is well to wash off the formal. The cells maintain their shape, and the nuclei of the cells take the stain in the usual way. Casts, and especially red blood-cells, are well preserved. Fat is readily distinguished. Micro-organisms are easily recognized even when unstained.—Modern Medicine.

BACTERIOLOGY.

Virulent Diphtheria Bacillus of the Conjunctival Sac.— Spronck (Deutsche Med. Woch., 1896, No. 36) undertook to learn, by means of the specific protective property of Behring's serum, whether the diphtheria bacillus and

those slightly virulent or non-virulent bacilli which re-
semble it are the same species of bacterium. Out of seven
cultures from the pharynx, there were five which pro-
duced a local edema and general disturbance in the guinea-
pig when injected subcutaneously. Guinea-pigs which
had been injected with a relatively large dose of anti-diph-
theritic serum were not rendered immune to the effects of
these cultures but the same dose of virulent diphtheria
culture was without effect.

He also experimented with three cultures of the bacillus,
resembling the diphtheria bacillus, isolated from typical
cases of xerosis conjunctivæ. Subcutaneous injections,
in guinea-pigs of medium size, of one to three cubic cen-
timeters of a 24-hours bouillon culture, produced edematous
swellings which disappeared after forty-eight hours, with
loss of appetite, weakness, etc. Guinea-pigs which were
rendered in a high degree immune to the diphtheria bacil-
lus showed no increased resistance to the bacillus of
xerosis.

The author concludes that the anti-diphtheritic serum is
useful in differentiating the diphtheria bacillus from the
slightly virulent xerosis bacillus. He thinks the results
with the anti-diptheritic serum leave no doubt that the
xerosis bacillus does not belong to the true species of diph-
theria bacilli but should be classed with one or more dis-
tinct varieties of bacilli.

He does not claim to settle the question as to whether
every bacillus which loses its effects in the presence of
the protective property of the anti-diphtheritic serum is
the true diphtheria bacillus, but leaves it to further re-
search.

Whether the diphtheria bacillus with slight virulence is
a common inhabitant of the conjunctival sac, he thinks can
be easily determined if all or most of the cultures possess
sufficient virulence to allow of control investigations. He be-
lieves, however, that most of such are organisms which
belong in the class of xerosis bacilli. He does not deny
that the true diphtheria bacillus may be found in the con-

junctiva in specific diphtheria and other infections and in the normal conjunctiva on rare occasions.—Medicine.

On the Xerosis Bacillus.—J. Eyre (Journal of Pathology and Bacteriology, July, 1896) gives a report of interesting studies upon the bacillus of xerosis conjunctivæ. Twelve cases were examined, six being in males and six in females. Of the females, two were classmates and the remaining four were members of one family—an interval of about a week was noted between the onset of the attack in the mother and the three children. The cases were characterized clincally by a number of small, irregularly oval-shaped, pinkish, edematous bodies, situated in the lower conjunctival fornix, and not encroaching upon the ocular conjunctiva. Injection of the conjunctival vessels, lacrymation, photophobia, inability to continue at work requiring close observation, distress at night and when using artificial light, were among the symptoms.

In contrast to these cases he reports a case of true conjunctival diphtheria. The patient was a boy aged four years. Both eyes were affected, the lids being painful, red, and swollen, and separable with difficulty owing to the brawny infiltration of the subcutaneous tissue. The ocular conjunctiva was chemosed; the palpebral portion congested and thickened, presenting patches of a pale grayish-yellow membrane, which stripped off easily, leaving a raw bleeding surface.

The differences between the xerosis bacillus and the diphtheria bacillus are given as follows:

1. After inoculation of the secretion upon blood-serum, colonies of the xerosis bacillus do not appear within thirty-six hours; those of the diphtheria bacillus appear in sixteen to eighteen hours.

2. When grown in neutral bouillon or milk, the xerosis bacillus never gives rise to an acid reaction; the diphtheria bacillus invariably does.

3. When grown upon potato, the xerosis bacillus rapidly degenerates and dies; the diphtheria bacillus grows with more vigor and to a greater size than on any other medium.

4. When grown upon 10 per cent gelatin, colonies of the xerosis bacillus are not visible to the naked eye within forty-eight hours; the colonies of diphtheria bacilli can be recognized in twelve to twenty-four hours.

5. The invariably innocuous nature of the bouillon cultures of the xerosis bacillus, when innoculated into the subcutaneous tissues of animals is susceptible to the bacillus of diphtheria.

As to the exact nature of the xerosis bacillus—whether it be a non-virulent and slightly altered species of the bacillus diphtheriæ, or a totally separate and distinct bacillus—it is impossible at present to decide.

Leucocytes and the Bactericidal Action of the Blood.—Hahn (Arch. f. Hyg., vol. xxv, p. 105) has investigated the action of blood serum and also the pleural exudation of rabbits. The leucocytes in the latter are destroyed by freezing. He found that the exudate had a more powerful bactericidal action upon Staphylococcus pyogenes aureus and bacillus typhosis than the blood serum or the defribinated blood of the same animal; and since the leucocytes were destroyed, the action cannot depend upon phagocytosis in Metchnikoff's sense of the term. The author made experiments with Lichenfeld's histin-blood, in which the leucocytes remained unaffected, in order to determine whether the bactericidal power depends upon the destruction of leucocytes or upon substances secreted by the leucocytes while still alive. He came to the conclusion that the latter is the more probable explanation.

Bubonic Plague Bacillus.—Dr. Alvah H. Doty gives a full account of the history and germ of the bubonic plague. In the year 542 Egypt was considered the home of the plague. Between 660 and 680 England was invaded. In 1334 it was brought from the East, where it was supposed to have had its origin. Sicily 1346, Norway 1351. The mortality was enormous. During the eighteenth century the plague existed only in Eastern Europe, Asia and Africa. A slight outbreak occurred in Delmatia in 1840, and a severe one on the Volga, in the province of Astrakan in Russia, 1878-79.

Since then it has not appeared in Europe.   In 1894 it oc-
curred in Hong Kong and Canton; in the latter place 180,-
000 people died.

The credit of discovering this organism is due to Yersin
and Kitasato, who worked independently in their investi-
gations.   The organism is known as *bacillus pestei bubonicæ*.
It is found in large numbers in the buboes characteristic
of this disease, in the lymphatic glands and occasionally in
the internal organs.   It occurs in the blood only in acute
hæmorrhagic types, shortly before death.

The organism has been cultivated in artificial media and
disease resembling it has been produced in lower animals.
It is pathogenic to many animals and during epidemics
rats, mice and flies die in large numbers, the disease being
apparently transmitted through them.

It is a short and thick bacillus, somewhat motile, with
rounded ends, somewhat motile, and stains with aniline
dyes, the ends coloring more deeply than the middle.   It
does not form spore.   It grows well in blood serum, in the
form of white moist, iridescent colonies.   It grows slowly
in gelatin but rapidly in glycerin agar, forming a grayish
white surface growth. In bouillon it grows in a very charac-
teristic way, resembling the growth produced by the ery-
sipelas organism.   The culture medium appears clear,
with white granular deposits on the walls and in the bottom
of the tube.

It is pathogenic for rats, mice, guinea pigs and rabbits,
which die usually within two or three days after inocula-
tion.   The bacillus soon loses its virulence when grown in
artificial media.   The virulence of the organism is increas-
ed by successive inoculations in certain animal species.

We are indebted to Yersin, Calmette and Borrell for the
antiplague serum. Animals are immunized against the at-
tacks of the organism by repeated intravenous or intraper-
itoneal injections of dead cultures or by subcutaneous in-
oculation. A horse was immunized in about six weeks.
The serum afforded protection to small animals after sub-
cutaneous injection of virulent cultures, and even cured

those that had previously been infected if administered within twelve hours after the inoculation. Yersin has recently reported the successful treatment of a man who was attacked by a severe type of the disease. The French Consul at Hong Kong performed the same operation upon two other pupils at the Catholic Mission with success.

Baldness Microbe.—One of the physicians at a hospital in Paris has, it is stated, discovered a microbe of the skin which accounts for baldness. It appears that baldness attacks those whose skin exudes an excessive amount of fat or oil, and the parts affected are washed with ether and other solutions, myriads of small microbes may be seen similar in length (!) to the tuberculosis bacillus. This particular skin microbe varies in size according to its age and position. For instance, on the scalp it is smaller than on the face or the body, but the structure remains always the same. The doctor has inoculated a sheep and a rabbit with the skin microbe at the Pasteur Institute, and he will make known the results of his experience to the Society of Dermatology. It is stated that there are three or four therapeutic agents capable of destroying the fatty substance of the skin complained of.

MEDICAL MICROSCOPY.

The Klebs-Loeffler Bacillus in Apparently Normal Throats and Noses.—W. H. Gross (University Medical Magazine, October, 1896) presents an interesting report of some observations made in the Children's Hospital of Boston. During six months ending June 1, 1896, culture examinations were made from the throats and noses of all cases entering the hospital; two cultures, twenty-four hours apart, being taken on admission, and subsequently repeated once weekly as long as the case remained in the house, unless the Klebs-Loeffler bacillus was found, in which case daily examinations were made until three successive negative cultures, twenty-four hours apart, were obtained. The work was undertaken with the object of

preventing outbreaks of epidemics of diphtheria, which in past winters had occurred in this hospital with most disastrous results.

Out of 316 cases examined, 26 at one time or another showed the presence of the Klebs-Loeffler bacillus. Two of these had clinical diphtheria, so that out of 314 normal throats and noses, 7.9 per cent contained the bacillus of diphtheria. The average persistence of the bacillus on the mucous membrane was fifteen days; the shortest period one day, the longest 103 days. The nose was the principal habitat in 65 per cent and the throat in 35 per cent. The degree of virulence possessed by the bacilli in the various cases was not determined.

Antitoxin in Diphtheria.—The American Pediatric Society are about to undertake a second collective investigation of antitoxin, and they now ask that records of cases of diphtheria involving the larynx, whether operated or not, occurring in the United States, be sent to the Secretary, W. P. Northrup, M.D., 57 East Seventy-ninth street, New York, N. Y.

The following sums up the conclusions of the Society based on the first investigation:

Dosage.—For a child over two years old the dose of antitoxin should be, in all laryngeal cases with stenosis, and in all other severe cases, 1500 to 2000 units for the first injection, to be repeated in from eighteen to twenty-four hours if there is no improvement; a third dose after a similar interval, if necessary. For severe cases in children under two years, and for mild cases over that age, the initial dose should be 1000 units, to be repeated as above if necessary; a second dose is not usually required. The dosage should always be estimated in antitoxin units, and not of the amount of serum.

Quality of Antitoxin.—The most concentrated strength of an absolutely reliable preparation.

Time of Administration.—Antitoxin should be administered as early as possible on a clinical diagnosis, not waiting for a bacteriological culture. However late the

first observation is made, an injection should be given unless the progress of the case is favorable and satisfactory.

Bacteria in the Urine in Non-bacterial Febrile Disease. —Chvostek and Egger (Wiener Klin. Woch., 1896, No. 30) report the occurrence of bacteria in the urine in paroxysms of malaria and in fever produced by injections of tuberculin. As the experiments were conducted in such a way as to exclude the usual causes of error in such observations, the authors believe that fever serves in some way to favor the excretion of micro organisms, though no bacterial disease in the usual sense exists. They suggest that this may be simply the exaggeration of a process which must occur at times in healthy persons. Bacteria gain entrance to the blood in various ways, perhaps most frequently by way of the lymphatics, and are finally excreted with the urine. These germs are probably more or less lowered in vitality, so that they cannot often be cultivated successfully; but in fevers such as the authors worked with, the excretion is more rapid. These and other observations show that the presence of non-specific bacteria, especially the Staphylococcus albus, in the urine cannot be looked upon as of great importance, and that other facts must be brought forward in order to prove their relation to the disease.

BIOLOGICAL NOTES.

The Scandal on Oysters.—At the recent meeting of the British Medical Association, Professors Boyce and Herdman took pains to show what persons familiar with the natural history of the oyster have known all along, that it is not a scavenger, as some people have ignorantly alleged but a cleanly and docile animal of slow movement and overtrustful of its pampering caretakers. Consequently it has been most foully treated. The professors cited and verified facts that had been before stated—namely, that when oysters were laid down in pure water a natural process of

cleansing took place, and previous sewage contamination was thus entirely got rid of. This result forms the highest possible argument in favor of the absolute purity of the surroundings of oysters during their cultivation or after being laid down in special beds for fattening purposes.

With regard to the germs of typhoid fever in sea water or in the tissues of the oyster, it was shown that they are viable for fourteen days in sea water at 35 degrees centigrade, while in cold sea water they may live for twenty-one days; and when large quantities of the microbes are added to the water, their presence may be demonstrated for a longer period than when small quantities are employed. It thus seems that the bacilli do not actually breed or multiply in the sea water at all. Infection from this source, therefore, is from germs that have entered the water, and not from their decendants and progeny. It was also demonstrated that the typhoid microbe does not increase either in the body or in the tissues of the oyster. Where oysters are infected with typhoid germs and placed in a stream of pure sea water, the bacilli disappear in from one to seven days. The oyster evidently utilizes its pure environment to get rid of its unwelcome and uninvited germ guests.

Distinctions Between Human and Animal Blood.— On mixing the blood in question with a little bile, there are formed crystals not exceeding 0.003 meter in size. Those of a man are right rectangular prisms; those of the horse, cubes; of the ox, rhombohedrons; of the sheep, rhombohedric tablets; of the dog, rectangular prisms; of the rabbit, tetrahedrons; of the squirrel, hexagonal tablets; of the mouse, octahedrons; of common poultry, cubes modified at their angles, etc.—Scientific American.

MICROSCOPICAL NOTES.

The Night Lunch Wagon.—Mr. John F. Hurley, president of the water board, of Salem, Mass., who has been indefatigable in promoting a good water supply, has now

called attention to a matter which effects the public health in a different degree. Disclaiming any intention of needlessly interfering with any person's means of livelyhood, he has protested against the licensing of night lunch wagons, on account of the liability of the spread of disease by this means. These wagons are a familiar sight in the cities and larger towns. Either they are driving about the streets or they occupy a stand, night after night. Mr. Hurley has interested himself to inquire into their operation and finds when ready for customers the water supply of a wagon consists of about two gallons of water in a bucket. During the night several hundred cups of coffee and mugs of milk are sold and emptied into mouths many of which are dirty and diseased, some foully so. The cleansing of the mug or cups consists of a rinsing in the bucket of water and a wipe with a towel that does duty for the entire night. We must agree with Mr. Hurley that probably no better method of spreading disease can be found than the practices he discribes, and the subject is one which should receive the attention of the board of health in the cities where such a menace to public health exists.—The Engineering Record.

Infection by Pets.—Cats have been suspected of conveying the infection of diphtheria, and scarlet fever has been traced to them. To this may be added (Chicago Medical Record) the unwelcome news that a health officer has reported a case of smallpox brought about in the same way; that is, by a cat from an infected house carrying the disease to a neighboring house.

Another case is reported in La Medecine Moderne, "of a seamstress who was in the habit of allowing her dog to lick her face. She was attacked one day with a severe inflammation of the right eye. Oculists were consulted, but their treatment was unsuccessful; and owing to the fact that inflammation of the left eye was beginning, the right eye was cut out. In it was found a tapeworm, which the dog had probably picked up while licking some less pleasing object than his mistress's face.

"The danger of the transmission of parasites by dogs, who are well known to be indiscriminate in choosing objects for the exercise of their tongues, to the hands and faces of their masters, would seem to be a great one. It is remarkable that accidents of the kind related happen as rarely as they do."

MICROSCOPICAL SOCIETIES.

Royal Microscopical Society.—At the last meeting of the society, Mr. F. Enoch, F. L. S., F. E. S., showed under microscopes a unique collection of specimens of "a much neglected family," viz., the mymaradæ. These insects, some of them much tinier than a grain of sand on the seashore, are egg-parasites, that is to say, they prey on the eggs laid by other insects—some of them in the live bodies and still other minute denizens of London trees. The researches conducted by Mr. Enoch have brought to light some eight hitherto unknown genera, and latest was discovered at Holloway. Mr. Enoch prepares, mounts, sketches and photographs the specimens for which he hunts by night and by day in London and the suburbs, and the exhibition which he arranged was of much interest.

New Jersey State Microscopical Society.

Monday, April 26, 1897.—At Kirkpatrick Chapel, Rutgers College Campus, New Brunswick, N. J., was held the twenty-eighth anniversary meeting of the New Jersey State Microscopical Society. An efficient committee, chairmaned by Dr. Chester had striven to make the meeting attractive to the public and had signally succeeded.

Dr. Julius Nelson, President of the Society, made a brief speech of welcome and introduction. He called attention to the fact that the Society is not among the least educational factors in this city. Meetings are held, month by month; popular subjects, easily understood, are treated of by specialists; and the public is always welcome, admission being given gratis. The facilities offered are unique in this city.

"The microscope," said Dr. Nelson, "has made greater revelations than the telescope. The views which you shall behold this evening, projected from a polarizing apparatus perfected by Dr. Van Dyck, have not been shown to an audience of this kind before."

Dr. Van Dyck then explained the polarizing projection lantern, giving the theory of light vibrations and telling the effects of interference between waves of light. Polarization is acquired when all parts of a medium move alike and in the same direction. By means of a bundle of glass plates, arranged in a certain way, he had perfected the projecting apparatus.

While Dr. Van Dyck managed the lantern, assisted by Frederick H. Blodgett, secretary of the society, Dr. Chester explained the views. They were magnified from the slides 160,000 times, being projected from a one-quarter inch aperture to an area upon the screen of about eight feet.

"Beautiful" is too feeble a word to describe the tints which the rock crystals and the organic particles assumed under polarized light. Again and again, as the more exquisite specimens were shown, the audience gave expression to its delight in applause. When inorganic specimens—crystals formed by chemicals—were projected, much amusement was occasioned. By some arrangement of the apparatus, the crystal "wheels went around," changing their hues the while.

Part II of the scientific entertainment was held in the lecture room in the rear of the chapel. Here were half a hundred microscopes, with specimens well mounted and displayed under both electric and oil light, arranged on tables. The visitors passed up one row of microscopes, peeping into the tubes as they walked, and down the other row. These were the exhibitors and their exhibits:

College Experiment Station; Photo-micrographic Camera

Dr. J. B. Smith; Eggs of the Tape-worm, Head of the Tape-worm, Mouth of the House-fly, Mammalian Sperm, Wing Cover of a Beetle.

Dr. B. D. Halsted; Starch in Cells of Bean Seed, Spores of a Parasitic Fungus, An Akebia Stem, Carnation Rust in a Leaf.

Mr. F. B. Kilmer; Section of Sponge, Bacillus pyocyanus.

Dr. P. T. Pockman; Stomata in Fern Leaf.

Mr. F. H. Blodgett; Protococcus, Zoospores of Draparnaldia, Mandible of Lady-bug.

Mr. F. H. Blodgett; Wild Flowers.

Dr. W. W. Knox; Foramenifera.

Dr. A. C. Hutton; Pappus of Marguerite.

Prof. C. L. Speyers; Spicules of Gorgonia.

Prof. W. S. Myers; Humming Bird Feathers.

Dr. A. H. Chester; Arranged Diatoms.

Mr. J. M. Devoe; Tongue of Beetle, Foot of Spider.

Dr. M. H. Hutton; Fossil Diatoms.

Mr. F. C. Van Dyck Jr.; Pollen of Japan Lily.

Dr. F. C. Van Dyck; Micro-photograph of Plants.

Dr. D. C. English; Section of Human Appendix, Kidney of Mouse.

Dr. H. R. Baldwin; Hair Bulb, Flea, Cheese Mite, Feather of Goose.

Dr. F. M. Donahue; Section of Scalp.

Mr. J. A. Manley; Iron Pyrites.

Dr. Caroline H. Marsh; Section of Spinal Cord.

Mr. L. H. Noe; Platinocyanide of Yttrium.

Dr. Julius Nelson; Frog's Kidney, Human Kidney, Human Hair.

Dr. Julius Nelson; Various Hairs, Various Fibres.

Mr. W. W. Wilson; Root-cap.

Mr. L. T. Ives; Butterfly Scales.

Dr. A. L. Smith; Normal Artery.

Dr. N. Williamson; Pathological Artery, X-ray Photograph of Ibis.

Mr. W. S. Valiant; Casts of Triarthus beckii.

Mr. Thomas Craig has found an apparently new rotifer. The peculiarity of it is in the fact that it is enclosed in a case made of grains of sand and small diatoms.
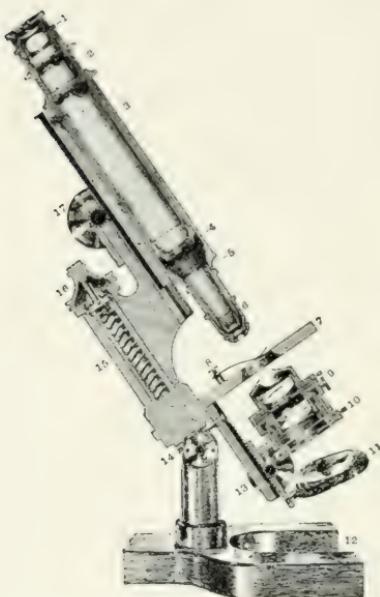
THE MICROSCOPE IN SECTION.

1. Compensation ocular x 12 ; it is a positive ocular.
2. Draw-tube, by which the tube is lengthened or shortened.
3. Main tube or body, to the lower end of which the objective or re-
   volving nose-piece is attached.
4. Society screw in the lower end of the draw-tube.
5. Society screw in the lower end of the tube.
6. Objective in position.
7. Stage under which is the substage with the sub-stage condenser.
8. Spring clip for holding the specimen.
9. Screw for centering, and handle of the iris diaphragm in the achro-
   matic condenser.
10. Iris diaphragm out-side the principal focus of the condenser for use
   in centering.
11. Mirror with plane and concave faces
12. Horse-shoe base.
13. Rack and pinnion for the sub-stage condenser.
14. Flexible pillar
15. Part of pillar with spiral spring of fine adjustment.
16. Screw of fine-adjustment.
17. Milled head of coarse adjustment.

[From Gage's "The Microscope and Microscopical Methods."]

On a New Fossil Marine Diatomaceous Deposit in Alabama.

BY K. M. CUNNINGHAM,

MOBILE, ALA.

In the issue of this Journal for August, 1896, there appeared a paper giving an account of the results secured by myself from an examination of a rather wide area of strata of Tertiary age undertaken during the month of June 1896. It contained much of interest in relation to the various kinds of microscopic fossil organisms found in the various deposits encountered, and in the same article I referred briefly to the locality around Suggsville. At the time of preparing that paper, I had inadvertently overlooked a few specimens collected near Suggsville. In December last while arranging and labeling specimens of the minerals previously collected I found some small samples of clay. It occurred to me that I had not made a micro-analysis of the same, and with this in view I made a trial test. I found that the material indicated a very interesting deposit of fossil marine diatoms hitherto unknown, and offering much of interest to diatomists and microgeologists in general. After ascertaining this fact it became necessary to secure a relatively large amount of the deposit for the purpose of introducing the same to the notice of all who might desire to study the contents and peculiarities of the new deposit. I therefore found it necessary to communicate with Dr. C. I. Dahlberg, of Suggsville, indicating the situation of the

deposit, requesting him to visit it and send me a quantity of the deposit. Through his kindness I secured some fifty pounds of clay, and after the receipt of the fossil clay I was enabled to make a study of the deposit.

After preparing and examining the equivalent of about fifty slides, I became sufficiently acquainted with the chief characters of the deposit, to enable me to make some comparative deductions with reference to the two principal sources of North American marine fossil deposits. These are generally known and familiar to American and foreign microscopists. Such deposits are known as occurring at Monterey, Cal. and at other sites on the Pacific Coast. The deposits on the Atlantic Coast are found at Nottingham, Md, Richmond and Petersburg Va., and at other points from New Jersey to South Carolina.

As a result of the studies made from a relatively small quantity of the deposit, not amounting to more than a few ounces in the aggregate, I have been enabled to note and tabulate species represented by the following genera: Amphora, 5; Amphiprora, 4; Auliscus, 3; Aulacodiscus, 3; Actinocyclus, 3; Actinoptychus, 6; Asterolampra, 2; Amphitetras, 2; Biddulphia, 6; Coscinodiscus, 10; Craspedodiscus, 2; Cocconeis, 1; Cyclotella, 2; Corinna, 2; Diatoma, 2; Dimeragramma, 1; Diploneis, 3; Eunotogramma, 1; Glyphodiscus, 2; Hyalodiscus, 2; Hemiaulus, 2; Melosira, 5; Navicula, 10; Pleurosigma, 3; Pyscilla, 2; Pseudoauliscus, 1; Rutilaria, 1; Raphoneis, 2; Synedra, 1; Triceratum, 6; Trinacria, 2;—approximating one hundred species in the aggregate. Associated with the diatoms are additional fossil organic remains viz. some 20 species of Foraminifera, 6 or more of Radiolarians, various sponge and gorgonia spicules, minute spines of echinoderms; stellate spicules, zanthidian spheres, and coccoliths of the chalk resembling those of the recent sea bottom; also crystals

of selenite, and matted crystalline plates.   The contents
of the deposit offer many points of study interest.

With regard to the richness of the deposit, it becomes
only a question of concentration and cleaning as the dia-
toms are in illimitable numbers, a fragment as large as
a lima-bean yielding three or more slides of the usual
size.   A few peculiarities to be noted by the student are
of the following character.   The Coscinodiscoidal forms
range in size fron 1–50 inch to 1–500 inch.   Of Melosira
there are simple closed rings and spiral forms of two
or more turns ; filaments of Melosira having as many as
fifteen frustules united together.   The Triceratia are
sometimes found in filaments of three or four frustules
in a linear series ; spherical Coscinodiscii united in pairs
in a partial fissión or sporangial stage.   In these the
external hemispheres are fully completed in their reticu-
lar surfaces, and the internal halves either perfectly or
partially formed, but still enclosed by the sporangial
isthmus or hoop.   There are Amphitetras in prefission
union or sporangial stage inclining the frustules to rest
on the longer axis.   The discoidal forms of all kinds
have both valves united to the hoop thus enabling the
sculptural details of either top or bottom surfaces to be
examined with equal facility in focussing down from one
surface to the other or vice-versa.

By this means, it is seen that in all of the Aulacodiscii
or Glyphodiscii having processes or bosses on both sur-
faces that upon focussing on the upper surfaces, and then
through to the lower surfaces the bosses or processes of
the lower surfaces bisect the position of the upper bosses.
This furnishes a proof that the valves are intact, a cir-
cumstance seldom observed in other fossil deposits.

The formation in which this deposit is found is known
as gypsous in character.   This is owing to the fossil
Foraminifera and Diatoms having been mineralized or
metamorphosed by two agencies. As a result this tends to

make the cleaning and preparation of the diatoms for study somewhat difficult, or at least a lengthy process. The diatoms are associated with a tenaceous clay matrix very difficult to eliminate by boiling or acid treatment. It may be easily removed by trituration on a soft rubber surface freeing the silicious organisms in abundance; and when they are so freed, it is noted that the surface and interior of the diatoms, especially the Biddulphia, and Actinocyclii, are densely packed with crystalline bundles. These crystals may be removed by digesting in a mixture of equal parts of sulphuric and hydrochloric acids.

It will also be noted that the larger Coscinodiscii are encrusted with blackish spherules of ironpyrite. This can be removed by digesting in nitric acid. When the acid treatment is properly carried out, fair slides may be prepared ; but while the requirements noted here may seem formidable or tedious, there is a very simple and direct process that any one can use for all essential purposes of study. For this purpose it is merely necessary to take a piece of the crude diatomaceous clay as large as a lima-bean, wet it with water, place it in the palm of the left hand, and crush it down by the pressure of the fingers of the right hand. Then with the tip of the index finger of the right hand the clay is continuously triturated until no visible small particles or lumps are evident. In the trituration, utilize as much surface of the palm as the hand will permit. The triturated layer is then removed clean from the hand by a pocket knife blade and transferred to a small shallow saucer-like vessel. Water is added, and the paste is dabbled, which will free the diatoms. Allow them to settle to the bottom. The clay water is then poured off carefully, and additional water added a few times to remove the remaining flocculent matter. Then the diatoms may be readily concentrated by a gentle twirling on an incline and tilting to one side. Then a pippette will remove the dia-

toms leaving the larger and coarser portions to the rear. By this means enough diatoms may be secured for a trial study of five or more slides from a very small piece.

This simple process is susceptible of great refinement when properly done. It is the most expeditions way in which to get acquainted with the characters of the deposit; whereas, if the process does not give satisfactory results at the hands of anyone trying it, the customary process of boiling in alkaline, or acid solutions would have to be resorted to. More time is thus consumed and it will scarcely remove the amorphous clay particles which are apt to interfere with a good concentration. I deem the suggestions given herein as pertinent, as the deposit belongs to the category of deposits seldom available, and thus involves experimental tentative processes for its mastery.

The deposit offers a problem to the chemist, viz: to find an acid or combination of acids which will promptly dissolve the compound mineral which has metamorphosed the internal chambers or casts left by the Foraminifera. These shell casts seem to be proof against four of the commoner reagent acids. This problem offers a fine experimental field in the line of micro-chemistry.

If a simple water cleaned slide of the diatoms is placed under the microscope using a 1 inch or a $\frac{1}{2}$ inch objective remarkable chemical phenomena may be observed. By depositing a drop of sulphuric acid on the slide, and then adding a drop of muriatic acid, every foraminiferal form will be violently attacked and torrents of gas bubbles will be thrown off in streams until the internal casts within the foraminifera are exposed. Then the power of the acids is at an end. In the meantime the diatoms will have been materially brightened, revealing the sculptural markings more clearly, where not masked by pyrites. The action of the nitric acid in dissolving the iron mineral does not present any phenomenon of inter-

est as it is rather slow in its action.   It seems to be essential in improving the appearance of the preparations.

During the course of my studies of this new deposit I made sketches of all the forms found in the material in the hope of being able to identify the various species, but I found that it was a hopeless task to identify the majority of the species with certainty.   I had available one Moller Type Plate, one Getchsman Type Plate, covering some five hundred species, Kain's Blue print copy of Adolf Schmidt's Atlas (80 plates only) and Wolle's Diatomaceæ of North America.   All of these were only serviceable as giving the genera alone.   The identification of the species with their aid was impracticable. The identification of a species involves the highest critical skill, as indicated in the critical notes attached to Schmidt's figures.   So I leave the determination of the species characterizing the Suggesville deposit to those who have a genius for such work.

Immediately on determining that I had found an interesting and new deposit with unfamiliar North American species I at once forwarded to Mr. J. Tempere, of Paris, a specimen of the new earth.   He replied that he had received the material, and that he would clean it, and send me a list of the species contained in the same.   Six months have elapsed and nothing in reference to the deposit has been received from him.   This may show that it takes time to determine with accuracy the species in an unfamiliar deposit.

Incidentally there is an element of scientific romance connected with the Suggsville find which may be stated in this wise: Some ten or more years ago a letter came to me from the Alabama State Geologist, Dr. E. A. Smith, enclosing a letter of inquiry to him from an Atlantic Coast Geologist. It asked whether there was a known fossil Marine Diatomaceous deposit within the bounds of Alabama.   The party writing was interested in the sub-

ject from a geologic standpoint. The letter was referred to me for a reply, as I was supposed to be the only person in Alabama that could give the information.

At that date nothing was known of a fossil Marine deposit of any kind, not even a fresh water fossil deposit was known. We only had available the recent Marine Diatoms of the Gulf and the likewise recent fresh water sources. Since that date, the whole Diatom subject is practically exhausted for this locality, and duly put upon record for the benefit of the whole world.

The writer of the letter proved to be Lewis Woolman, of Overbrook, Pa., but latterly of Philadelphia, Pa., who in connection or in collaboration with the Geological Survey of Pennsylvania, has been identified with the study of water-bearing strata or horizons as determined through the study of Artesian well borings and other sources. He is also the originator of an hypothesis involving the assumption that, in the epoch in which the Miocene strata were laid down or deposited, there was deposited along the Atlantic Coastal area a series of Diatomaceous clays, one stratum of which in particular represented by a deposit of at least 300 feet in thickness, and designated by him the "great 300 foot diatomaceous stratum." He had reason to believe it might be traced somewhere all along from New Jersey to the Florida peninsular, and sweeping around to and occupying a portion of the Gulf of Mexico Costal plain even into Alabama.

It was with the object of collecting data to verify his assumption, that he sought the aid of many correspondents in securing material with which to establish the truth of his hypothesis. I rendered him every reasonable assistance by furnishing specimens. By this means, I put upon record at different periods, the important fresh water deposit of Montgomery, Ala., the fossil marine Diatomaceous clay from the Tampa, Fla. phosphatic area, the pyritized and mineralized diaotms of the Mobile, Ala.,

artesian well area clays 650 below surface, also the Rad-
iolarian and Diatomaceous clays of the Buhrstone Eocene
of Alabama and Mississippi, the Holothurian fossil re-
mains of the Clarke Co., (Miss.) marls.

All of these various deposits were but of inconsequen-
tial interest to his purposes, as none furnished data of
direct use to him. But finally a ray of hope dawned
giving new zeal to his hope of finding the missing link
in his data requirements, when the 15 feet or more stra-
tum of a marine fossil diatomaceous clay was announced
by me as found in the vicinity of Suggsville, Clarke Co.,
Ala. Mr. L. Woolman since then has had the satisfaction
of getting the material wherewith to study the corres-
pondence of the Alabama deposit in its specific forms,
with the material and specific forms characterizing the
composition of the Miocene clays of the Atlantic Coast.

The Geological Map of the State of Alabama locates
Suggsville in the area of the Eocene designated as E. 1.,
equivalent to the St. Stephens; (Vicksburg; White
Limestone, and Jackson) or uppermost member of the
Eocene, while the true Miocene should rest upon this
group of strata. A comparative study of the Pacific
Coast Diatomaceous species and that of the Atlantic
Coast species of the Miocene age by me suggests that the
Suggsville deposit is more nearly allied to those of the
Pacific deposits than to those of the Atlantic Coast.

Foraminifera of the Marine Clays of Maine.—By Frank
S. Morton, Portland, Maine. 8 vo., 18pp., 1 plate.

This is a paper extracted from the proceedings of the Port-
land Society of Natural History for 1897. After a brief
description of the localities from which the material
was derived, the writer gives the systematic classifica-
tion of the forms, and bibliographical notes. Students of
the Rhizopoda can perhaps obtain a copy by writing to the
author at Portland.

Remarks upon the Diatomaceæ.

BY J. G. WALLER,

LONDON.

[From the President's Address before The Quekett Club.]

They are ubiquitous, and found everywhere in water, whether in the ocean, or river, or the merest trickling rill. It is an interesting fact, you can in many instances predict the character of what you will find, according to the conditions under which they exist, and they have more than any other organism been favored by constant research. The development of the microscope itself has gone on coincidently with our knowledge. Some diatoms have long been test objects wherewith to examine the highest powers. At the time when Ehrenberg wrote, probably most observers considered with him that they belonged to the animal kingdom ; and this view lingered on, finding its supporters even when Andrew Prichard, in 1861, published his admirable compilation on the "Infusoria." Although this is now quite given up, one must not condemn too readily views that were partly suggested by the movements of certain species. Truth is a growth, the result of observation, but it is slow in progress, as the history of opinion on the most important of subjects declares unto us. But, if we assume that the movement of the Naviculaceæ was due to animal nature, the next step was to tell us how this was accomplished. So some observers distinctly saw a ciliated apparatus. This, however is the old story ; you can always see what you wish to see, that which your mind has determined ; and it is not agreeable to many, perhaps to most minds, to think that your eyes may deceive you. Yet this is a lesson that the microscopist must learn, and it is an important one. The study of the Diatomaceæ continually imposes this upon us. One species has exercised all

the faculties required in minute examination—the Pleurosigma angulatum— which has in itself a history singular in the various waves of opinion and attempted demonstration.   The markings of its silicious envelope at first presented striæ, which further magnification determined into a series of semi-circular bosses, or at other times, according to other views, so many depressions or apertures.   The first was once attempted to be illustrated by a glass tumbler, the sides of which consisted of so many raised bulbs.   It was thought that a similar material would be similarly affected by the action of light and thus would prove, or tend to prove, the true construction of the valve.   In the theory of elevations, it is not so long ago that arrangements were made in side illuminations by a pencil of light, thus supposing to give a true and artistic light and shade.   But, in both these nice experiments, it seemed to be forgotten that they were begun in a foregone conclusion ; and, as I have previously said, you naturally, in such a case, see what you wish to see.   Certain accidents, fractures, and peculiarities inconsistent with the above-named views, assisted by careful illumination, seem now to have tolerably settled the question to be on the side of apertures, and my predecessor has worked successfully thereto.   That this must be the general consent on such markings throughout the Diatomaceæ must probably be entertained, though it would be dangerous to affirm that there was no variation from it in the multiform changes of nature.

But the subject has been so admirably worked out and recorded by two papers in our Journal, one by Mr. C. Haughton Gill, April, 1890, in which is well described his mode of preparation of the objects wherewith to determine the structure.   Another by Mr. Nelson, in May, 1891, goes into the same matter by the use of high powers, and these papers, showing a working on differ-

ent lines, yet arriving at the same results, commend themselves as conclusive. Nor can we forget the eminent services on diatom structure rendered by our Secretary, Mr. Karop, associated with further ideas on their development. But the diatom will never cease to be of primary importance to the microscopist, as the abundance and variety of its forms even exhaust our imagination, and the volumes written upon it, though numerous, seem to be only forerunners of more to come.

I have alluded to the movements which were once thought to be one of the reasons to indicate animal life, as seen in the Naviculaceæ ; but in these forms it is by no means so remarkable as in one less commonly met with, viz., the Bacillaria paradoxa, wherein a number of parallel rods slide out side by side on each other, in a manner so curious as to challenge all hypotheses to clearly explain them to us.

But movement can in no way of itself be recognised as a distinction of animal nature, and many examples of the Algae, notably that of Volvox globator, go far beyond what is seen in any of the Diatomaceae, and sometimes there is a lingering of opinion here, as to which order the latter should belong. Hesitation of this kind has its value, as it directs attention to the subject, and, finally to a decision. Sponges are now relegated to the animal kingdom, but it is singular that doubts on this should have belonged to modern science; for Pliny, who wrote at the beginning of the Christian era, in his curious compilation, entitled "Natural History," distinctly saw the true place they should occupy.

One might quote eminent names near to our own time who have taken a different view, and it is remarkable, that one of such large experience as the late Dr. Gray, of the British Museum, should have been once on this side and considered the spicules the analogues of the hairs of plants. This comes out in a passage of arms between

him and Dr. Bowerbank, who could not avoid giving so
home a trust as to remind him of it.   Even after it was
generally allowed that they belonged to the animal king-
dom, a reservation was made for sometime before the
fresh-water sponges were placed in the same position.
Observers could not have seen, as I have, the blow-fly
hovering over and depositing its eggs, attracted doubt-
less, by the offensive odor of decomposing flesh.

How the Bacterial Organisms are Studied.

By J. E. LAMB, M. D.,

WAHOO, NEBR.

The technique of investigating these microscopic plants
is manifold.   Microscopy alone is inadequate.   Identifi-
cation requires other tests than those afforded by the
microscope.

These tests are :—1. Staining agents.   2.   Appear-
ance of cultures.   3.   Reaction to heat and oxygen.   4.
Pathogeny.

1. *Staining agents.*—Watery solution of the aniline
dyes penetrates the protoplasm in the cell bodies of most
bacteria, yet the tubercle bacillus long eluded observa-
tion because it absorbs the solution only when the water
is reinforced by some other agent like carbolic acid or
alcohol.   This microbe is stained with great difficulty,
but once stained, it is very resistant to decolorizing
agents.   Upon these facts, all staining solutions and
methods of staining are founded.   Some operate slowly,
others more rapidly.

In order to appreciate and differentiate the tubercle
bacillus, the following solutions and methods of use, are
more easy and simple to manipulate than any others with
which the writer is acquainted.   It is hoped they may
prove as acceptable as those you are now using.

I.   Fuchsin pulv, 15 grains; Alcohol, 2 drams; Aquæ distillat, 1 ounce.

II.   Aquæ distillat, 1 ounce; Liquor ammonia, 3 minims.

III.   Alcohol, 1½ ounces; Aquæ distillat, 6 drams; Nitric acid, ½ dram.   Aniline green, to saturation.

To stain :

1.   Gently press a small part of the most solid portion of the suspected sputum between two cover glasses.

2.   During five minutes, place one cover glass in equal portions of solutions one and two, heated till vapor rises.

3.   Rinse in water, put a drop of solution three on it, rinse again.   If the mount is not a distinct green, put on another drop of solution three, wash again, dry and examine.

The use of the following will also afford gratifying results :

Ziehl's Solution.—Fuchsin pulv, 1 part; Alcohol, 10 parts; Acid carbolic, 5 per cent. sol., 100 parts.

Gabbet's Solution.—Methylin blue, 2 parts; Acid sulphuric, 25 per cent sol., 100 parts.

1.   Prepare mount as above, hold high over a flame until dry.

2.   Place cover-glass in Ziehl's solution five minutes.

3.   Place cover-glass in Gabbet's solution one minute.

4.   Dry, examine with oil immersion.

If a hurried diagnosis is unimportant, but permanent mounts desired :

1.   Place cover-glass, with dried sputum, in Ziehl's solution twelve hours.

2.   Hold in nitric acid, 25 per cent solution, till brownish black.

3.   Hold in alcohol five seconds.

4.   Hold in water one second.

5. Dip once in two, three, and four, if color is deeper than light pink.

6. Cover mount with Gabbet's solution two minutes.

7. Dry and examine as above.

A one-eight or one-sixth objective, in other words, the enlargement of 400 diameters, with or without eye-piece multiplications, produces a clear field sufficient for diagnostic purposes.

Alcohol mixed with fresh sputum in order to preserve it, coagulates the albumen which should be softened with a two per cent solution of caustic potash before spreading over a cover-glass. A saturated solution of borax preserves the sputum, liquifies the mucus and does not coagulate the albumen.

Most cocci take Gram's staining readily. The gonococcus, however, being an exception, will not take Gram's method, this being one of its main diagnostic features. It takes all the ordinary aniline stains.

Gram's Solution.— Iodine, 1 part ; Potassi Iodidi, 2 parts ; Aquæ distillat, 100 parts.

The potash is not indispensable but added to facilitate solution.

2. *The color of colonies.*—If the individual bacteria in any given species be grown on a suitable soil, such as gelatine, bouillon or potato, there results a mass or colony of these minute plants whose size, shape and color afford essential means of differentiating the organisms, and the bacteriologist uses them for recognizing his minute plants just as the chemist uses the behavior of a given substance to identify his still more minute molecules. The streptococcus grows into light gray colonies while the staphylococcus produces bright yellow.

It is only when growing in masses that enough color is formed to be visible. Not infrequently are these colored masses so luminous that they can be photographed by their own light when placed in a dark room.

Indeed, the color of our mischievous microbe played a conspicuous part in many of those natural phenomena which, by their lack of apparent cause, were in early times relegated to the domain of the supernatural. That wavering, cold, uncanny phosphorescent light, seen at night time in putrid plants or by the sea side, is our innocuous microbe. The consecrated wafer placed in the bacteria-laden air of the church edifice over night was found besprinkled with crimson drops in the morning.

The legends are long and tragic of the dire calamities, unmentionable crimes and swift retributions which the strange appearance of our chromogenic microbe was supposed to foreshadow.

A recourse to the supernatural to elucidate all these natural phenomena, is no longer necessary, for to-day, we cultivate and study the tiny bacillus prodigiosus which made the drops of blood, the mingled green and blue phosphorescence.

3. *Heat* and *Oxygen*.—Like the larger plants, different species of bacteria require different temperatures for their growth. Most all grow well at 60° to 80° F., but the tubercle bacillus ceases to grow below 92° F.

As microbes assume very diverse forms in accordance with the nature of their environments, so also their habitat and mode of life divide them into very distinct classes.

The aerobines can subsist only when they breath the natural oxygen they withdraw from the atmosphere.

The anaerobines live within fluids and living organisms and derive the oxygen necessary for their respiration from the oxygenated substances in which they are found. To the latter class, belong all microbes which provoke pathological changes when introduced into the blood.

4. *Pathogenesis*.—Living animal tissues afford unfavorable soil for bacterial growth. When introduced

into animals a large majority produce no appreciable
effect. It is now known, however, that upwards of
thirty species are capable of nourishing themselves in
animal tissues. No species is pathogenic in all animals
but each only in certain kinds. The anthrax bacillus
grows well in sheep but refuses to grow when planted in
dogs and cats. Hence, the behavior of a given species
when inoculated into different animals, is another means
of differentiating the organisms.— St. Louis Medical
Review.

Algæ found at Roche Abbey, July 11, 1896.

BY J. NEWTON COOMBE,

CHAIRMAN OF THE SHEFFIELD SCHOOL BOARD.

The result of my microscopical examination of the
gatherings taken from the Sandbeck Lake, and from the
'Wishing Well' and Lake at Roche Abbey, on the occa-
sion of the Yorkshire Naturalists' excursion there on the
11th of July, 1896, has been eminently satisfactory as
regards the Diatomaceae, which were the objects of my
special investigation. Taking the above-named waters
in the order in which they were visited, the well-known
water weed (Myriophyllum) which grew very freely in
Sandbeck Lake, and for a tube of which I am indebted to
the courtesy of Mr. J. Stubbins, of Leeds, proved to be a
favorite habitat for the following stipitate species of the
Diatomaceae :— Cocconema cymbiforme, Gomphonema
curvatum, G. constrictum, Achnanthes exilis, as well as
of the needle-like Synedra radians, and the curious tube
dwelling and somewhat uncommon Encyonema prostra-
tum, the frustules of which last-named species move and
pass one another up and down their hyaline mucous-
made tubes in very curious jerky fashion.

The parasitic members of the family were well repre-
sented on the same weed by Cocconeis placentula, which
appears like so many small lozengers stuck all over and

along the decayed portions of the weed from which the
chlorophyll had departed. I was fortunate enough to
find in Mr. Stubbins' gathering two of the frustules of
this species in the interesting state of 'conjugation,'
although too much attached to the weed to admit of being
separated and mounted without injury to the specimen.

Coming to the water of the 'Wishing Well' at Roche
Abbey, a dipping from which brought me by my wife
some two years ago was found to contain an almost pure
gathering of the by no means common filamentous Dia-
tom Odontidium mesodon (W. Sm.), I was not a little
pleased on this my first personal visit to find floating in
the depths of the cool clear well water, a brown silk-
worm-silk-like and perfectly pure mass of this interest-
ing alga. After so successful a second find of this par-
ticular diatom, which I may say I have never met with
in so pure and healthy a condition in any other of the
numerous waters which I have examined in various parts
of South Yorkshire, the 'Wishing Well' at Roche Abbey
ought certainly to be noted by Yorkshire naturalists as
a place to be visited by the lovers of freshwater algae in
their search for "gems."

Proceeding to the Lake close to the Abbey ruins, it
was but a few minutes before I detected upon the surface
of this picturesque water a small piece (about an inch
square) of that peculiar-looking yellowish-brown scum
which to an experienced eye is a certain indication of a
'good find' of Diatomaceae. Upon examination under the
microscope the gathering, of which, needless to say, I
very quickly secured a tube, proved to be in many
respects similar to an extremely fertile one I made some
three years ago from the lake at Thoresby. Its special
feature was its richness in unusually large frustules, .001″
in length, of Pleurosigma attenuatum, which, after care-
ful cleaning and boiling in nitric acid, give a brilliant
opal iridescence of great beauty under dark ground illu-

mination with a magnification of two or three hundred diameters.

I have been able to identify and to mount in Canada balsam, and also dry, the following 58 species of the Diatomaceae in this one gathering, of which over 40 may be seen on a single slide under a ⅜ in. circular cover glass :—

Pleurosigma attenuatum	Navicula tumida
" lacustre	Stauroneis anceps
" spencerii	Cymatopleura solea
Nitzschia sigmoidea	" elliptica
" parvula	" apiculata
" amphioxys	Cymbella cuspidata
Tryblionella angustata	Amphora ovalis
" gracilis	" minutissima
Surirella biseriata	Diatoma vulgare
" ovalis	" elongatum
" linearis	Odontidium harrisonii
Pinnularia viridis	" mutabile
" viridula	" parasiticum
" oblonga	Denticula sinuata (?)
" gracilis	Gomphonema curvatum
" acuta	" constrictum
" radiosa	Cyclotella kutzingiana
Navicula cuspidata	Cocconeis placentula
" firma	Synedra ulna
" amphisbæna	Cocconema lanceolatum
" elliptica	" cistula
" gibberula	" cymbiforme
" inflata	Encyonema prostratum
" affinis	" cæspitosum
" cryptocephala	Achnanthes exilis
" binodis (?)	Eunotia monodon
" bleischii (?)	Melosira varians
" veneta (?)	Fragilaria capucina
" producta	Colletonema neglectum

This time of year and want of rain were not favorable for Desmids, but I came across a few vigorous specimens of the following species :—Closterium striolatum (showing very clearly the phenomena of cyclosis and so-called 'swarming of the granules' at its extremities), Pediastrum granulatum, Cosmarium botrytis, while among the less

common of the filamentous algae, I was fortunate enough
to find in the Roche Abbey Lake, and subsequently to be
able to mount in its own water a well defined gathering
of Oscillaria spiralis, the curious and unexplained move-
ments of which (as of a headless screw turning continu-
ally on its end) were extremely interesting to watch.

Several other and more common species of Oscillaria
and at least three species of Spirogyra and Zygnema
were abundant in the Lake.—The Naturalist.

Some Facts About Podisus Placidus.

BY A. H. KIRKLAND,

AMHERST, MASS.

During the month of May, 1896, while making field
observations in Malden and Medford, Mass., upon the
insects known to attack the gypsy moth, Porthetria dis-
par, I found that many of the common predaceous bugs
upon emerging from hiberation greedily availed them-
selves of the food supply offered by the tent caterpillar
and destroyed large numbers of this insect. They enter-
ed the tents and prey upon the insects.

When feeding, these Pentatomide insert the setæ only,
and not the sheath, into the body of the caterpillar. I
have watched them very carefully under a hand lens
and my observations fully agree with those of Mr. Mar-
latt, as given in the Proceedings of the Entomological
Society of Washington, D. C., Vol. II., p. 249. I have
seen P. placidus extend its setæ beyond the end
of the beak to a distance equal to the length of the
last rostral joint. When the setæ are inserted in a
strongly chitinized part, the struggles of the larva often
pull them from the sheath. In such cases the beak is
drawn through the fore tarsi in the same manner that an
ant cleans its antennæ, and thus the setæ are forced back
into the sheath. I have also removed the setæ of P. cy-

nicus from the sheath by means of a fine needle applied
along the labrum and have seen them replaced in the
same manner. The nymphs of this species were also
found attacking the larvæ of the currant sawfly.—Can.
Entomologist.

EDITORIAL.

Restriction of Vivisection.—A bill is pending in the U.
S. Senate to restrict vivisection. Numerous men who
consider themselves accurate observers are opposing it
and are representing that it "prevents experiments upon
living animals." They show themselves to be neither ac-
curate observers nor accurate readers for it does nothing
of the sort. The bill permits :—(1) All the experiments
performed while the animal is insensible to pain, (2) All
kinds of surgical operations for testing new methods of
surgical procedure, (3) The testing of new drugs or medi-
cines, (4) All kinds of inoculation experiments or bacterio-
logical investigations into the causes of diseases.

Out of 1239 replies from the leading physicians written
on this subject, 968 have favored such restrictions as are
made in this bill.

Dr. L. E. Rauterberg, late of the microscopical divi-
sion of the Army Medical Museum has written to a senator
as follows :

It was my lot for a number of years to be engaged in the
microscopical division of the Army Medical Museum,
where I saw practiced the most inhuman and barbarous
mutilations of animals under the supervision, and with the
sanction, of the United States officer in charge. A desired
part or section of the animal would be removed, not under
anæsthesia, and the poor beast would be then placed back
in its cage or vessel until it suited the convenience of the
operator to help himself to another portion so long as the
animal would survive these tortures. I have thus seen ani-
mals with eyes, sections of brain, and other parts removed
and kept in reserve for future experiment for a number

of days, and for the verification and repetition of results obtained and published years ago.

These unnecessary horrors, practiced openly with sanction of United States medical officers, make me think that stringent laws are needed to restrict such proceedings. None should be permitted not calculated to give additional useful information, and then under perfect anaesthesia, and under the supervision of a board of competent men assigned to that duty.

Aware of the possibility of such a condition in a scientific institution located in the District of Columbia and under the control of a government so supine, can any one, knowing of the existence of the above-named abuses, oppose a bill that aims to make such conduct amenable to law?

Nomenclature.—It has always been a source of surprise to us that men will spend so much time over questions of nomenclature and even of classification. The real nature of plants and animals furnishes a great variety of topics for study, and we ought to be able to interest ourselves therein to the exclusion of contests over nomenclature. Nomenclature has usually been based on a few superficial characters and has therefore been liable to incessant change as the result of discovering new facts. All this is a false view of matters and is not scientific.

A scientific nomenclature would be absolutely arbitrary. Let blue things be called viridis; let short things be called longus; let it be fully understood that pending the acquisition of full knowledge of a form our name is no clue to its characters. We must call it something but it matters not what we call it if we agree upon its name. An arbitrary name once affixed, let no one challenge it or seek to change it. As a sample of the foolishness which men of pseudo-science are forever indulging in, the following quotation will be of interest. It is from the Presidential Address delivered before the London Quekett Club recently and it is proper to apologize for filling our space even to this extent with such nonsense. Mr. Thomas and Mr. Carter are both too sensible men to waste time in frivolity.

Mr. Waller is wiser but might perhaps still better have omitted all allusion to the facts. In another place he shows good ideas of nomenclature by asking whether the names Leidyi, Millsii, Muleri, Baileyi, Capewelli, Ramsayi, Everetti, give anymore information than letters or numerals. We far prefer the numerals.

The quotation is as follows:

"When Professor Hitchcock, of the United States, was over here a few years ago I gave him a specimen of the Ditchleys spongilla for his collection, and others also distributed by or through me found their way to America, and I sent a slide to Mr. Carter. After some time had elapsed I heard that Mr. B. W. Thomas, an earnest worker of Chicago, had found the same variety in the river Calumet, and seeing its identity with that of Ditchleys, and finding that, in my description, I had declined specially naming it, he proposed to call it Meyenia calumetica. Then Mr. Carter, who had received a specimen from Mr. Thomas, saw that it was identical with that he had received from me turned his attention to the subject, and in an elaborate article in "Ann. and Mag. of Natural History" gave it the name of Meyenia angustibirotulata, which title Mr. Edward Potts, in his admirable "Monograph on the Freshwater Sponges of America," has accepted. Mr. Thomas then feels annoyed that he should thus be superseded, as Mr. Carter had, in the first instance, declared against its being a variety.

For myself, who first discovered it 19 years ago, and might have claimed some voice in the matter, I could not be otherwise than amused at the little quarrel amongst my friends, I having decided against giving the variation any separate name, my views leading me in another direction.

One satisfaction I have, however, gained in the knowledge that the Spongilla of the riverCalumet is also found growing upon the stem of aquatic plants, as it tends to establish, what one would naturally feel, that similar conditions produce similar results."

MICROSCOPICAL APPARATUS.

Distilling Water.— The most inexpensive method of distilling water is always a practical question. I have an apparatus that I had made which cost but little, and can be made upon a comparatively large or small scale— viz., for a small oil or gas stove to one the size of a cook-

stove, and can be made by any tinner or by any one who can cut tin and use a soldering iron.
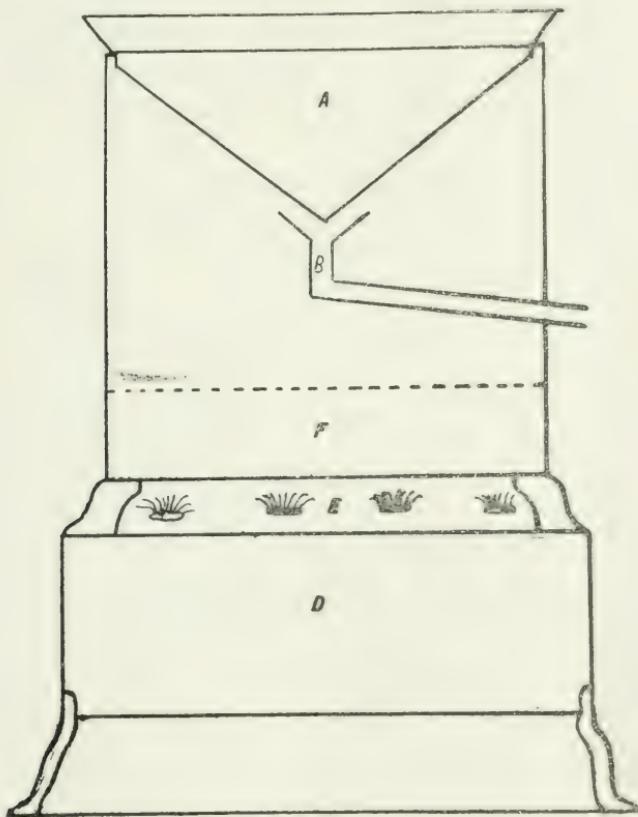
Select the stove the size you wish to use, and the diagram will explain the process. A is the compartment for ice or cold water, F the water to be distilled, D the stove. The receptacle containing the ice or cold water should be

made to fit the lower receptacle tightly the same as the cover of an ordinary tin pail, and it will be readily seen that the steam rising from the water underneath coming in contact with the cooled surface above would condense and running down the cone-shaped condenser, drop into the small funnel.

As you will see, this can be made to fit the smallest of oil stoves, or any size larger as desired.   It can also be used to make all kinds of flavoring waters by dropping the article, inclosed in a cloth, into the water to be distilled, the strength being determined by the amount put in.— A. J. Harris in Pop. Science News.

Note on Color Illumination. —Julius Rheinberg has designed a new form of substage differential color illuminator in order to simplify and facilitate the use of color discs and other stops in the substage of the microscope. It consists essentially of a box, or slide carrier fitted under the condenser, in which there are a number of metal slides which can be pulled out or pushed in quite independently of one another by means of little handles on both sides of the carrier. Each slide has two circular apertures, the one being fitted with a color disc or other stop, the other one being left free.   The kind of stop is indicated on the handle.   The openings in the slides are so arranged that when the apparatus is closed all the free openings coincide, so that illumination can be effected in the ordinary way. When any other illumination is required it is only necessary to pull out the particular stop, or combination of stops, each stop being in accurate position when pulled out as far as it will go.

In the apparatus there are 19 stops, viz., a dark ground stop, four stops which cause the background to assume various colors, four which cause the object to assume various colors, stops causing the object to be illuminated in different colors from opposite sides in various colors (for showing striations), and one causing the object to be illuminated in different colors at right angles to each other for showing striation etc., similarly situated.   There are also

stops for oblique light, several annuli, and a ground glass stop, making a compendium no doubt somewhat too great for the general worker, but which is very serviceable to the experimentalists.

As far as color discs are concerned the stops are so arranged that all those which can be pulled out from the left side of the carrier cause the background to be colored whilst those which can be pulled out from the right side cause the object to be colored.

The number of effects which can be obtained with such an apparatus is unlimited. Mr. Rousselet showed us some weeks ago an ingenious color illuminator, by which, according to a little mathematical calculation, 36 effects could be obtained. By applying a similar calculation to this arrangement it would give some few hundred millions of combinations. This number may be too much even for an enthusiast, and one may prefer to pass over from the quantitative to the qualitative use of the arrangement.

For simplicity in use it cannot be excelled, as it allows of every kind of illumination and stop, being automatically brought into action whilst the object is under examination. The best result can, therefore, be obtained with far greater rapidity than ordinarily, and comparisons can be effected without having to bother about taking stops in and out, as in the ordinary way. The apparatus, although efficient, is needlessly clumsy and heavy. The principle can be easily adopted in a neater form, and made to fit any condenser.

How to Test Objectives is the subject to which but few pharmacists and physicians pay much attention. In a lengthy article on the subject by Dr. A. C. Stokes, published in the *Journal of the New York Microscopical Society*, the writer says: "A severe test, then, or one that should come within the ability of the objective, and so fulfil the conditions of the ideal object for the purpose, is, for a first-class four-tenth-inch, the black dots of *Pleurosigma angulatum* in balsam, and perhaps, and imperfectly, the secondary structure of *Arachnoidiscus Ehrenbergii*; for a one-fifth

inch, the longitudinal lines of *Surirellagemma*, and the secondary structure *Isthmia nervosa* with the postage stamp fracture ; for a one-eighth inch or for higher powers up to the owe-twelfth the dotted secondaries of *Craspedodiscus elegans* in certain conditions.

MICROSCOPICAL MANIPULATION.

To Stain the Ringworm Fungus.— Adamson recommends the following method for permently staining trichophyton :—1. Soak the hair in a 5 to 10 per cent solution of caustic potash on a slide for ten to thirty minutes. 2 Wash in 15 per cent alcohol in water. 3. Dry on slide, and in the case of scales fix by passing through the flame. 4. Stain fifteen to sixty minutes in aniline gentian violet made in the usual way, by adding a few drops of saturated alcoholic solution of gentian violet to aniline water. 5. One to five minutes in Gram's iodine solution. 6. Decolorize in aniline oil two to three hours or longer. 7. Remove superfluous aniline oil by blotting paper. Mount in Canada balsam.—Phar. Jour.

Frozen Sections.—Ethyl chloride might profitably be employed in preparing frozen sections for histological purposes. The results thus far obtained have been exceedingly satisfactory, and, while the method is somewhat expensive, no accessory apparatus is required for the microtome.

Hamilton's method of preparing the tissues for freezing gives good results. Another way of getting the tissue ready is that recently advised by J. Orth. One hundred parts of Muller's fluid are mixed when wanted with ten parts of formol. Small pieces of the tissue under examination are fixed and hardened in this solution in the incubator for three hours. At the end of this time they are removed and thoroughly washed, and alcohol is gradually added until they are placed in 95 per cent alcohol. This latter re-agent must, of course, be removed before the tissue is frozen. If desired, after washing, the specimen

may be at once transferred to the solution of acacia and sugar and frozen. Or, as suggested by H. Plenge the piece may be placed in a 4 per cent formal-dehyde solution for a quarter-of-an-hour, and then frozen in the same solution.

When the tissue has been prepared in some such manner, or even when perfectly fresh, it is placed with some formol and gum acacia fluid upon the specimen-holder of the microtome, and a small stream of chloride, methyl chloride or anestile (a mixture of these two re-agents) is played from above directly upon the specimen.

The tube containing the ethyl chloride is held about a foot from the specimen, and moved from place to place until the specimen is firmly attached to its base of support and the upper portion is coated with a few crystals of ice. These crystals are extremely small and delicate, and, therefore, do not injure the tissue so markedly as in some other of the freezing methods. The specimen is readily frozen in from 30 seconds to a minute. Sections are then cut and placed in water or fifty per cent alcohol, and mounted in the usual way. Excellent stained preparations may be prepared in fifteen minutes or less from the time that the tissue is removed from the body.

BACTERIOLOGY.

Differentiation of the B. coli from the B. typhi abdominalis.—Elsner (Zeitsch. f. Hyg. XXI.) uses plates prepared with Holtz's potato gelatine, to which, after it has been made slightly acid, 1 per cent of iodide of potash has been added. Even on this unfavorable medium the B. coli grows freely and quickly, but no colonies of the B. typhi abdominalis are visible for 48 hours, and they appear as extremely fine small, shining patches, like drops of water. Controling his experiments by Pfeiffer's immune-serum process, Elsner always obtained positive results from typhoid stools. Piorkowski, at the Berlin Medical Society June 10, 1896, reported experiments in cultivating these bacilli on agar, bouillon, and gelatine mixed with urine,

which had been suggested to him by the presence of B. coli in the bladder. On these media the microbes grew luxuriantly, forming greyish colonies ; the B. typhi abd. less rapidly in fine transparent patches. In the discussion Elsner said there were plenty of differential signs ; the difficulty was to cultivate Eberth's bacillus when it was only present in small numbers—for instance, in water, or mixed with other bacteria, for example, in stools. Ewald, Wolf, and Senator, all had found Elsner's method very useful for the diagnosis of doubtful cases from the stools.— Brit. Med. Journal.

BIOLOGICAL NOTES.

Fertilization of the Gymnosperms.—A very important discovery in the mode of impregnation in Gymnosperms made by two Japanese botanists, Professor S. Ikeno and Dr. S. Hirase, which was recently referred to in our pages, supplies a most interesting link between this section of Phanerogams and the higher Cryptogams. Dr. Hirase has discovered that in Ginkgo bilaba, Salisburia adiantifolia, impregnation is effected by antherozoids formed within the pollen-tube. The two nuclei resulting from the final division of the generative nucleus of the pollen-tube are converted, before entering the oosphere, into motile antherozoids, resembling those of the higher Cryptogams, but differing somewhat in form. They are ellipsoidal 82 microns long by 49 microns broad, and contain in the centre a nucleus entirely surrounded by cyptoplasm. The main body consists of a head composed of three spiral coils, and a slender tail; to the former are attached numerous cilia. As soon as the antherozoids have escaped through the apex of the pollen tube, they enter the oosphere with a rapid twisting motion. Attraction spheres were observed accompanying the final division of the pollen-tube nucleus. Professor Ikeno has made a similar observation respecting the mode of impregnation in another Gymnosperm, Cycas revoluta. The antherozoids are here somewhat larger than in Ginkgo ; the main body is composed

. of four coils, to which are attached a large number of cilia; but the swarming motion was not actually detached. The nucleus is surrounded by cyptoplasm. They are found in pairs in the extremity of the pollen-tube, and result from the bi-partition of the genative nucleus. Professor Ikeno states that the structure of the male and female organs in Ginkgo biloba and Cyeas revoluta at the time of impregnation differs from that observed in any other Gymnosperm in this respect; that while, in the latter, the pollen-tube penetrates deeply into the archegone, in the two species under discusion it never reaches the archegone itself, but remains, at the time of impregnation, at some considerable distance from it. It would therefore be impossible for the pollen-tube-nuclei to impregnate the oosphere without being previously transformed into motile antherozoids. Fertilization is then rendered possible by the copious excretion of a watery fluid by the archegone at the time of impregnation. Further details of this most interesting discovery are promised.

The Wild Nettle is known to contain a remarkable number of useful qualities. The leaf is edible, and the liquid to be obtained from the stalk makes an excellent beverage. The fibre of the stalk may, under treatment, produce an excellent silk. For ages the plant has been used for this purpose in China, where it grows to a height of seven or eight feet. Only recently, however, has the machinery necessary to make the manufacture of this silk a profitable industry been produced. A machine called the decorticator has been invented, by means of which the fibre is stripped off in enormous quantities at a terific speed. Ramie is the eastern name of the plant.—The Counsellor.

The Foot of the House Fly.— I have succeeded in mounting a specimen of the fly's foot with the pulvilli and tennent hairs stained, and showing, adhering to the ends of the hairs, the viscid globules by means of which the insect is enabled to attach itself to smooth surfaces. I have a fly's foot so mounted and stained with fuchsin,

which may be fairly well shown under a good dry lens. The details, however, are seen better with an oil immersion. Some of the hairs on this slide show the sickle filaments deeply stained and devoid of any adhering substance; others have a small quantity of the gummy fluid held within the hollow of the sickle, while the majority of the hairs are tipped with large globules that could easily be mistaken for permanent knobs or suckers.

The specimen also distinctly shows that the shafts of the hairs fringing the pulvillus do not spring separately from it, but each root or stem forks off near the base, forming two hairs.

I had hoped that staining would have rendered visible the orifice from which the adhering substance exudes, as the opening should be large, considering the size of the attached globules, but no such orifice has been detected. Judging, however, from the way the viscid substance seems in most cases to be held within the hollow of the sickle, it appears possible that a slit may exist along the filament capable of expanding and allowing the substance to exude freely.

The foot in question has been subjected to no cleaning process. Any attempt at such would inevitably clear away the globules adhering to the hairs, as is the case in ordinary preparations.—Eliot Merlin.

Preservation of Flowers.—The following is a very old method of keeping flowers without loss of color: Dry some very fine, pure siliceous sand in the sun or oven; then take a wooden, tin-plate, or pasteboard box sufficiently large and deep, and place your flowers inside erect; then fill the box with sand until the last is about an inch above the top of the flowers. The sand must be run in gently so as not to break the flowers. Cover the box with paper or perforated card board and place it in the sun-light, oven or stove; continuous heat gives the best results. After two or three days the flowers will be very dry, but they will have lost none of their natural brilliancy.—Journal of Horticulture.

DIATOMS.

Reproduction of Marine Diatoms.— Mr. G. Murray records some remarkable observations on the mode of propagation of certain pelagic diatoms collected off the coast of Scotland, chiefly belonging to the genera Buddulphia, Coscinodiscus, and Chætoceros. In Biddulpdia mobiliensis, "cysts" were observed within the parent cell, with only slightly silicified membrane, and destitute of the characteristic spines. These cysts appear to have the power of dividing and multiplying before assuming the characteristic parent form. A similar phenomenon was observed in Coscinodiscus concinnus, but in this species the protoplasm divides before the production of the "cysts," two of which were found within the same parent frustrule, differing from one another in form and in the width of the girdle-zone. It is not uncommon to find the young colonies of Coscinodiscus in "packets" of eight or sixteen ; this being apparently the result of further binary division within the frustules, which are found accompanying them in an empty state. The membranes of these young colonies are only very slightly silicified or not at all ; and they are, therefore, capable of increasing in size. A similar formation of "packets" of eight or sixteen young individuals within the parent frustule was observed in several species of Chætoceros.— Proc. Royal Society of Edinburgh.

NEW PUBLICATIONS.

A Text Book of Histology. By Arthur Clarkson, Pp. 554, and 174 original colored illustrations. Bristol: J. Wright & Co. Price 21s. net.

In it will be found a full account of the latest, well-authenticated discoveries in the microscopic anatomy of the human body, and a very complete description of the preliminary processes necessary for making either temporary or permanent microscopical preparations of the various tissues. The colored illustrations form a prominent fea-

ture of the book, and although perhaps in a few cases somewhat diagramatic, it must be conceded that for the most part they show extremely well the principal features visible in successfully stained histological specimens.

Browning's Paracelsus and other Essays.—By J. D. Buck. Robert Clarke Co., Cincinnati. 12mo., pp. 101. 1897.

This little pocket volume containing four short essays is suitable to take along these summer Sundays when going into the woods or fields alone hoping to feel the touch of Nature. To read of Paracelsus, of Genius, of the Music of the Spheres, or of Idols and Ideals while lying on the grass amid the fragrance of flowers or the hum of insects will help to a glympse of what most men and women never see and do not know to exist—something non-material within, about and around the material form.

I well remember my first experience of the "Music of the Spheres" in Switzerland in 1895. Only he who has heard it, however, will treat this essay as other than imaginative. He who wishes with sufficient earnestness to sense it can perhaps get assistance from this book.

The azure-blue cover and the gilt top make Dr. Buck's book a neat little present. The price is probably not over fifty cents.

Microscopic Researches on the Formative Property of Glycogen. Part I., Physiological. By Charles Creighton, M. D. Royal 8vo, pp. viii.—152. (London: Adam and Charles Black. 1896.) Price 7—6 net.

Glycogen is that substance in the animal body which corresponds very closely with the starch of plants and its appearance in the cells of different tissues during development. The book is illustrated by five well-executed colored plates. Chapter I is an Historical Introduction ; II treats of Methods and Material— viz., Microscopic Method, method of using iodine, preservation of sections, color of the iodide of animal starch, and reaction with methyl violet. The remaining eleven chapters treat of glycogen as found in various parts of the animal body.
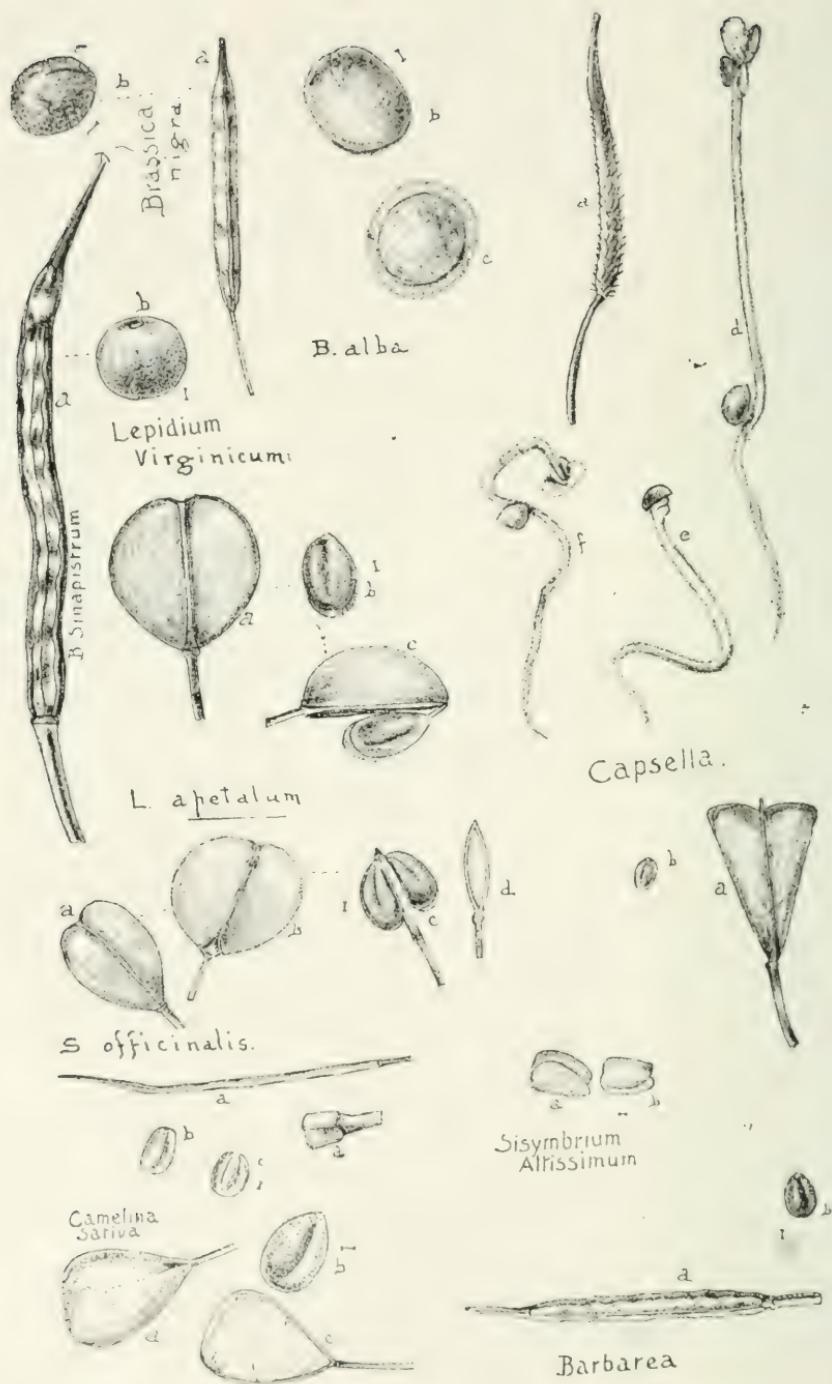
Brassica nigra

b

a

B. alba

b 1

c

Lepidium Virginicum

b 1

B Sinapistrum

a

Capsella

a

d

f e

L. apetalum

a

1 b

c

Capsella.

a

b

S officinalis

a b 1 c d

b a

Sisymbrium Altissimum

a b

b 1

Camelina Sativa

b c a

d

b 1 c

a

Barbarea

SEEDS AND TESTA.

On the Seeds and Testa of Some Cruciferæ.

By L. H. PAMMEL,

AMES, IOWA.
WITH FRONTISPIECE.

It has been known for a long time that cruciferous
seeds, when placed in water, become mucilaginous. Grew,
the early anatomist, was acquainted with the mucilagin-
ous character of some cruciferous seeds,—Camelina, Tur-
ritis, and Lepidium, as well as the plaintain and Ocimum
bassilicum. In this paper Grew refers to the use of
seeds to collect foreign matter in the eye.[*]

De Candolle, in an early paper on Brassica, calls atten-
tion to the mucilaginous character of the seeds of the
genus. The descriptions given by systematists are
brief. The microscopic details are not noted. The follow-
ing more recent writers have studied cruciferous seeds :-
Caspary, Hofmeister, Sempolowski, Abraham, Schroe-
der, Henkel, Heraud, Schimper, Moeller, Harz, Hanau-
sek, Strandmark, Wiesner, Flueckiger and Hanbury,
Flueckiger and Tschirch, Tschirch, Tschirch and Oesterle,
Klencke, Hoehnel, Kiaerskou, Strasburger, Sachs, Hager,
Nobbe, Vogl, Berg, Oudeman, Garcke, Luerssen, Royle
and Headland, Tietschert, Kratzman, Schenk, Behrens,
Frank, J. D'Arbaumont, Van Tiegham, Godfrin, Zim-

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[*]"Anatomie des plantes. Qui contient une description exacte de leurs
parties et de leurs usages et qui fait voir comment elles se forment et com-
ment elles croissent. French Translation, second edition, Paris, 1679, p. 199.

merman, Bonnier, Hicks, and others. Some careful stud-
ies were made by Frank, Sempolwski, Hoehnel, Schroeder,
Harz, Abraham, and D'Arbaumont.

During the past winter I had occasion to study sever-
al of our cruciferous weeds and in that connection a
study of the seeds and testa revealed some interesting
points, so that it has seemed wise to publish the results
of this work, though it is not complete with reference to
all the species described in Gray's Manual. The seeds
are so characteristic that our weedy species are easily
distinguished.

The seeds are round, flattened, oval, rough or smooth.
These characters can be made out easily in sections. Cot-
yledons flat, incumbent, — the back of one cotyledon
lying against the caulicle, or accumbent with the edges
of the cotyledons towards the caulicle, or longi-
tudinally plicate and partially enveloping the caulicle
or conduplicate in cross section (Mustard) or spirally
coiled in some cases. A section magnified shows that
the testa consists of two well-defined layers and some-
times of a third, which is much compressed. The cell-
walls of the outer portion are mucilaginous; those of
the second thick-walled. The aleurone layer which
various authors have considered as belonging to the testa
is endosperm. Strasburger speaks[*] of the seed as
being exalbuminous, and most systematic botanists so
speak of it in this way. In the sense that this term
was used by early systematic botanists this is cor-
rect. Humphrey has called attention to the aleurone
layer of seeds and the use of the term. Endosperm of
this character is found in the seed of many Legumino-
sæ where it cannot be made out with the naked eye.
We have not thus far found it wanting in the order
Leguminoseæ. This layer corresponds to that found in

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[*] Handbook of Practical Bot., English translation, Hillhouse, p. 339.

seeds of grasses and, as in that order and in Legumino-
sæ, the cells are filled with aleurone.

In Cruciferæ several rows of thick and poorly defined
cells follow the aleurone layer, being especially marked
between the caulicle and cotyledons. The cells of the
embryo are quite uniform in size. Distributed through
the cotyledons and caulicle occur the procambial vessels
and the myrosin bodies in which myrosin is formed.
This, according to Spatzier, is for protection and to break
up the glucosides.

USE OF MUCILAGE.

The first and most obvious use of mucilage in crucifer-
ous seeds is for the purpose of dissemination, especially
in all smaller seeds. This can easily be seen in seeds
like those of Lepidium and Capsella. And secondly for
the retention of water on the surface, but this is of minor
importance.

BRASSICA.

The anatomical structure of the seed of the genus
Brassica has been studied by numerous investigators.
We may mention the following: Oudeman, Tschirch,
Harz, Flueckiger and Hanbury, Hoehnel, Hicks and
others.

BRASSICA NIGRA, KOCH.

Pods smooth, one half to three fourths inch long, four
cornered, erect, attached to a short pedicel and tipped
with a short beak about one eighth of an inch long, about
nine seeded. Seeds are black or reddish brown, occa-
sionally grayish when more or less moistened; minutely
reticulated. The seeds of this species are much smaller
than in B. Sinapistrum—three fourths of a line in diame-
ter.

The cuticle covers the epidermal cells as a continuous
layer; when mounted in alcohol the outer layer is very
much compressed and shows very slight stratification;

the cell walls expand and after it has been moist for a considerable time the cuticle breaks. Stratification is very evident on the addition of water. The second layer consists of rather thin walled parenchyma. The cells of this layer differ greatly with reference to their size, being scarcely at all developed in places, in others nearly as large as the cells of the outer layer.

The third layer consists of thick walled parenchyma cells, densely packed, radially elongated, thick walled, sides present a cone-shaped appearance. Underneath this is a layer of thick-walled parenchyma cells which contain some coloring matter. The endosperm follows this layer. The first layer consists of thick walled cells, densely packed with albuminous matter. The remaining cells vary in number, much elongated, thick walled with a small cavity ; these cells extend down between the contiguous portions of the cotyledon or caulicle.

The Embryo:—The cells of the first layer surrounding the cotyledon or caulicle are smaller, filled with fat and protein grains. The remaining cells are larger also filled with fat and protein grains. The central part of the caulicle shows a differentiation of the embryonic vascular portion, consisting of small cells.

BRASSICA SINAPISTRUM, BOISS.

Pods one to two inches long, the seed-bearing portion somewhat torose and nerved, ascending, erect or sometimes appressed, tapering, prominently three to thirteen seeded, and tipped with the globular stigma, the upper one third to three fourths of an inch forming the beak, often with a seed. Seed globular, one line in diameter, brownish black, reticulated, the areas larger than in B. nigra, grayish when the seeds have been moistened, darker than B. nigra. When examined under the microscope with alcohol, the outer layer of cells is compressed, tabular, stratification not evident, cuticle well developed and forms a continuous layer over the outer cells ; on the

Brassica nigra
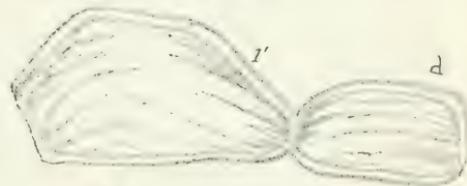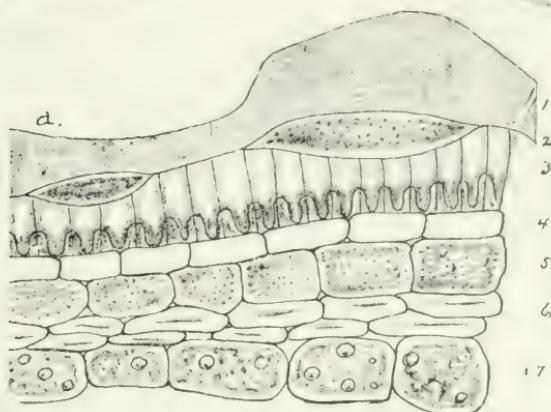
B. sinapistrum
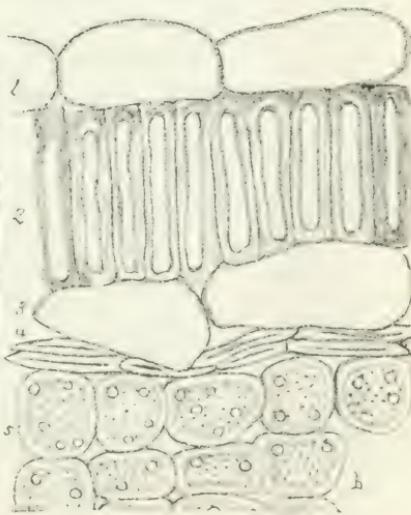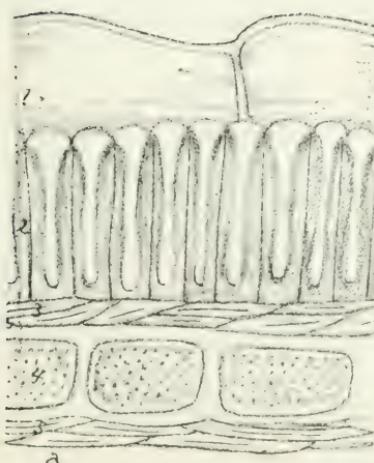
addition of water, the cell walls become mucilaginous, elongate, stratification becomes evident, the cuticle breaks and an irregular surface is formed. The second layer is but slightly developed, made up of thin walled parenchyma cells. The cells of third layer are elongated and thickened laterally. These cells are much longer than in B. nigra and brown in color. The fourth layer consists of one to two rows of rather thin walled cells carrying pigment. Endosperm consists of several rows of cells; first row nearly isodiametric, filled with protein grains. The three or four layers of cells following are thick walled with a small cell-cavity.

Embryo.—First layer of cells nearly isodiametric, those following somewhat larger, filled with protein and fat grains.

BRASSICA ALBA, BOISS.

Pod very bristly, spreading. Seeds pale yellow, round or somewhat oblong, one to one and a half lines in diameter, average a little over a line. Cotyledons incumbent, folded around the caulicle.

The seeds of this species have been studied by many investigators. Parts of the seed are much stronger developed than in B. nigra. The first layer of cells is covered by the well developed cuticle. On the addition of water a copious mucilage is developed, the cell wall becomes strongly stratified. A portion of cell wall surrounding the cell cavity is more yellow and has a stratification of its own. When water has been allowed to act for some time, the cuticle breaks, thus causing an irregular margin. Cells of the second layer are somewhat irregular, thin walled, with a large cell cavity and small intercellular spaces; as a rule composed of a single layer of cells but in some places two well developed layers. The third layer consists of cells with lateral thickened walls, which contain a yellow pigment. Cells in the fourth layer are also thick walled.

(*To be Continued.*)

The American Postal Microscopical Club.

Operations in 1896 and 1897.

BY R. H. WARD, M. D.,

TROY, N. Y.

[From Report of Management.]

THE MEMBERSHIP remains at about the average number of the last few years. Most of the Circuits are full and in good working order. There are, however, a few scattering vacancies where new members could be accomodated to advantage.

Since the last report the Club has lost by death several of the oldest and most faithful members :—T. B. Redding, Issac N. Himes, Geo. A. Rex, and J. C. House.

SLIDES AND NOTES—During a part of the season now closing, the supply of boxes reached the low-tide mark, necessitating the use of an exceptionally large proportion of the older and sometimes inferior boxes. Recent additions have restored an average supply, of more than average quality. Among the recent notable additions, the Club is indebted for gifts of fine special boxes from Professors Thos. D. Biscoe, Amos P. Brown, and Harry M. Kelly, Dr. D. B. Ward, and Mr. F. S. Morton ; and for extra slides from Doctors W. H. Sylvester, and D. P. Frame, Professor N. H. Conser and Mr. Thos. J. Bray.

Besides the ordinary notes, which have often been carefully prepared and valuable, and which it is hoped will receive increasing attention from our members, a large number of special notes, giving a thorough study or demonstration of important subjects pertaining to various new slides have been, and are being, prepared by a few of the more experienced members—especially Vice-President Vorce, Secretary Shanks and the President.

NOTE BOOKS—To deface them with careless scribbling or to mar them in any way, as by stamping, folding,

unnecessary soiling, etc., is an imposition on the members and readers for months and years afterwards. A member lately entered this valuable suggestion : "What a pity to write such an interesting paper with such miserable ink. Let the Club adopt a rule that each member shall type-write his paper, or shall use good ink and the vertical handwriting." While, unfortunately, not all the members can write the "vertical" hand, which is far the best for the notes, any more than all can be required to buy a typewriter, whose work is still more legible, it is not too much to ask for good ink, and, it should be added the careful use of a good medium-fine pen that will give work which is legible and compact. The only ink really fit for use in the notes is the "waterproof drawing ink," bottles of which can be bought for twenty-five cents from the dealers in drawing instruments and supplies, which flows freely and evenly, gives a very distinct line, and, being indelible, will bear handling without smutting, and will therefore wear better than typewriter work or the best of common writing inks. The best-written notes by a very few of our members, are nearly as legible as typewriter printing, and far more compact and durable. Being of a very different consistency from ordinary inks, it should be thoroughly experimented with, using stiff fine pointed pens and not too much ink (thinned if necessary according to accompanying directions), until fine, uniformly good work can be done, before putting it to practical use. Higgins' "American India Ink, waterproof (white label)," is generally used by architects and engineers.

Co-operation—It is a most suggestive fact that expressions of gratification are often made by able and cultivated people in regard to objects so common-place that a thoughtless person might be tempted to pass them by, unseen, with the superficial and flippant criticism that there was "nothing new in the box." This is worthy

of note as a reminder to the expert that many objects which are so familiar to him that he never thinks of offering them to the Club, are capable, with proper explanation, of being valuable to equally learned persons in different fields.

An object is named, not fully described by the label; and the most unpromising object may be valuable by reason of some peculiarity of structure, history or relations that can only be known by a careful view of the slide in connection with its note. Again, the most common slide may have a valuable note; some of the best notes ever in our books have been writen to the most insignificant slides, and there are members who could make valuable any slide that could be found. If both slide and note be found weak, what better satisfaction can a member get than to make it useful to his neighbors by his own suggestions ?

CIRCULATION—Owing in great degree to the energy and devotion of our Secretary, Dr. S. G. Shanks, and the kind co-operation of the membership generally, the circulation has been, amidst almost unsurmountable difficulties, kept up to a fairly good average. During the season now closing, nearly every circuit will have received thirteen or fourteen boxes, and with as much regularity as possible under the circumstances.

Ovum in Testis of a Lamprey.

BY R. H. WARD, M. D.,

TROY, N. Y.

[Abstract of remarks at the Microscopical Section of the Troy Scientific Association.]

This slide of Petromyzon is a good anatomical study, showing the essential male organ, the testis, in a riotously active state, producing clouds of spermatozoa; and also showing the characteristic ovum of the vertebrate ani-

mals, which is normally, though not here, the product of
the essential female organ, the ovary. But the anom-
alous origin of this particular ovum makes it one of the
most interesting specimens that could be seen under the
microscope. It also possesses, along with the interest of
a rarity and anomaly, the far greater philosophical inter-
est which always pertains to the beginning of things.
This production of one single microscopic ovum by an
elaborate gland that naturally, and here, but for this
exception, is devoted to a different and incompatible per-
formance, is a simple, uncomplicated first step in a line
of evolution, the first link in one of those "nature's
chains," about which we hear so much irrelevant and
unreasonable talk. It is the first unit toward the growth
of an ovarian body, or rather it is itself an absolutely
simple ovarian body, combined with a testis, and the
first beginning of the development of a perfect ovary in
the place of one of the testes. This is equally true
whether we regard the transition from testis to ovary to
be an advance to a higher or a degeneration to a lower
type. The latter, however, is probably true, since the
testis is not only further removed in structure from the
primitive and simple types of growth, but is more arti-
ficial and elaborate in its function. Evidently the ovum
and not the testis represents the multiplication of primi-
tive organisms by subdivision before male organs were
evolved and male functions established to render possible
higher grades of progeny.

In the vegetable kingdom such anomalies as that on
this slide often occur, and the transition is in the same
direction as here, from male to female and not the
reverse. Thus in the Indian corn, certain portions of
one or more of the staminate spikes that constitute the
tuft at the top of the stem sometimes produce ovaries
instead of stamens, and ultimately present well-developed
kernels of corn. Likewise among the willows it is the

staminate plant (tree) which reverts, abnormally pro-
ducing stamens that have an ovary in combination, or
that assume the pistil form altogether. Such stamen-
ovaries were circulated, by the present writer, in the club
boxes many years ago.

It is an interesting question whether in the case of our
slide the element of nutrition can possibly be the deter-
mining agency, the food-supply in this particular lobule
or sack being greater or less than usual, as the case may
be, or otherwise better suited to the making of ova than
of spermatozoa, and thus causing this strange growth.
It will be noticed that the mother cells of spermatogenesis
which in all the rest of this testis have abundantly per-
formed their work and filled the cavities and canals with
spermatozoa, and have themselves almost entirely disap-
peared, have in the lobule occupied by the ovum apparent-
ly suffered an arrest of development, and remain in the
lobule which is otherwise comparatively empty of male
products. Was the nourishment just here unsuited to
them, or was it so appropriated by the ovum that enough
was not left for them ?

The scarcity of spermatozoa in the immediate neighbor-
hood of this particular ovum seems to render its fertili-
zation improbable ; and the apparently exhausted stock
of food-supply in its lobule, and the absence of congested
blood vessels prepared to supply the rapidly increasing
demand of a devoloping ovum, seems to imply that this
ovule would have shriveled and disappeared from the
field of activity of this organ. But an imperfect or par-
tial development of an ovum might conceivably take place
sometimes without fertilization, and might easily go far
enough to demoralize an organ so little adapted to ovula-
tion as the testis is. On the other hand, if by some extra-
ordinary chance spermatozoa should be developed within
access of such an ovum and fertilize it, why should not a
(truly) "extra-uterine" pregnancy be established in the

male, which would equal in its character and consequen-
ces any of the miraculous freaks of nature that have ever
been recorded or dreamed of ?   It is fortunate for the
males of all kinds and degrees that such consequences
are infinitely improbable, and that such development, if
commenced, could not probably advance to any great
extent, owing to lack of suitable arrangements for nutri-
tion.

It is evident that this case is not an example of herma-
phroditism, in its full sense of possessing in an effective
form the organs of both sexes, and being able to perform
by turns or simultaneously the functions of both ; though
this seems to have been the theory accepted by the
ancients who coined this word to designate it, and who
left many carefully elaborated representations in their
art as to what they meant by it.   They knew little or
nothing of the anatomical difficulties and absurdities
which it implied, any more than they, without knowledge
of internal anatomy and physiology, realized the similar
absurdities of their schemes, likewise founded on exter-
nal form alone, of mermaids, centaurs, and the like. But
it is an hermaphroditism, in its first inception and sim-
plest conceivable form, in the more modern and reasona-
ble sense of a commingling, more or less, of the structures
peculiar to both sexes; and it is, again, a first step towards
a complete and effective hermaphroditism, if that be
possible.

The animal kingdom seems to have got, in the course
of evolution, mostly beyond the primitive grade of her-
maphroditism, which is still a prevalent policy in vegeta-
tion, where we find it generally but not universally pre-
sent.   Its very type is the presence of ovaries capable of
reproduction, and stamens capable of fertilization, both
on the same individual ; and we find this throughout the
range of complex individuality in the most familiar plants.
In the single flower we find both fertilized and fertiliz-

ing organs commonly though not always present; and the same words might be said of the flower-cluster or "inflorescence," and of the whole "plant," whether it be the tiny herb or the greatest tree. In some of the lowest forms, where each plant is but a single cell, and where the simplest conceivable form, perhaps, of sexual reproduction takes place by one of the plants merging itself into and thereby fertilizing another (conjugation), the cells are similar under the microscope, and unless there is some difference of structure as yet unknown, it may be assumed that each one is hermaphroditic in its powers, being able to fertilize or be fertilized as the chance may occur. So in the slightly higher grade of filamentous algæ, where the cells are united in a line, not apparently for interchange of food or products; but for securing advantage of position by serving as stalk to each other, and to that important extent constituting a true organism, the functions of fertilization seem to be completely mixed. When the filaments are crowded during the season of fertilization, their various cells fertilize their neighbors or are fertilized by them, apparently at random ; and unless there is a sexual difference of structure still invisible and unknown, these cells also must have hermaphroditic powers.

Microscopical Methods of Examination of Powdered Drugs and their Adulterants.

BY ALBERT SCHNEIDER, M. D.,

MINNEAPOLIS, MINN.

Recent applications of the microscope have opened a new field of work to the practicing pharmacist. Unfortunately, only a few of the colleges of pharmacy yet realize the importance of the microscopical study of powdered drugs. But in this age no one is worthy to be considered a leading pharmacist who is ignorant of it. It is now

possible for every druggist to determine whether or not he is dispensing unadulterated remedies. To detect adulterations should be regarded as a part of his duty.

The plea has been advanced that only a few can become sufficiently expert to do such work and that most men lack the required time. Now no advanced treatise upon pharmacognosy is necessary for the prosecution of this study. A pharmacist of average ability can in a comparatively short time become sufficiently familiar with vegetable histology and microscopical methods to do such work thoroughly. The one who advances such a plea as lack of time and of opportunity has surely no moral right to dispense medicines.

The more expert work must be left to investigators of high scientific training, and to those who possess the most desirable apparatus. But what is required for the work here proposed is only ordinary intelligence and average training, combined with application and a desire to be a credit to the profession. After a few months of self instruction, aided by the necessary apparatus and a reliable guide to vegetable histology and micro-chemistry any one can acquire a fair degree of proficiency.

The following suggestions as to equipment, methods and re-agents are especially intended for the benefit of those pharmacists who know practically nothing about micro-pharmacognosy.

Keep constantly in mind not to purchase a single piece of apparatus until it is actually needed. Only such apparatus and accessories as are required by the beginner in the study of powdered drugs, will be recommended herein. In getting an instrument the novice had best take the advice of some impartial and experienced microscopist.

In this country, the Bausch & Lomb Optical Co., of Rochester, N. Y., and Zentmeyer, of Philadelphia, Pa., are the leading manufacturers of microscopes and micro-

· scopical supplies. In Europe, Watson, of London, Leitz of Wetzlar, and Zeiss of Jena stand about equal as to their merits but the Zeiss instruments are higher priced.

The Leitz instrument, best adapted for the use of the pharmacist is the new stand IIC., with the following accessories : eye-pieces II and IV, objectives 3 and 7, double nose-piece, Abbe condenser and iris diaphragm. It is fitted with a graduated draw-tube, plane and concave mirror, and adjustable substage. The price of a good instrument with accessories is about $60.00.

Another indispensable accessory is an eye-piece micrometer, to be used in making measurements of tissues and tissue elements. This consists of a circular piece of glass set in a hard rubber ring. On it is a scale of 5 mm. ruled into 100 parts.

The following are more or less indispensible : 1. A good sharp razor for making hand sections. 2. A stage micrometer. This consists of a glass slide on which is a scale of 1 mm., ruled into 100 parts. This is required to determine the scale of measurement for the eye-piece micrometer. After the scale is determined no further use is had for this micrometer so one might be hired or borrowed. 3. A half dozen or more watch crystals. 4. Glass slides, with ground edges, and cover glasses. Two or three dozen of each will be enough for most purposes.

Other appliances, such as disecting needles, section-lifters, pincers, compressors, etc., are convenient but not absolutely necessary.

For the mechanism, care and use of the microscope, see these details given in text-books, of which the following are recommended : 1. Rusly & Jelliffe's Essentials of Vegetable Pharmacognosy. 2. E. S. Bastin, Laboratory Exercises in Botany.

Part two of both these books treats of microscopical methods and vegetable histology ; part one, of the gross

anatomy of plants. The book first named is better adapted to the needs of pharmacists. The Bausch & Lomb Optical Co. issue a small book on the mechanism, use and care of the microscope. V. A. Poulsen's Botanical Micro-Chemistry, translated by W. Trelease, is an excellent little work on micro-chemical reaction and chemical substances found in plants.

A considerable number of re-agents will be needed whose use will be indicated as occasion demands. Druggists will probably have most of them on hand. Staining, imbedding, and preparing permanent mounts, few pharmacists will care to know anything about.

Hæmoglobin and Its Derivatives.

BY A. J. BIGNEY,

MOORE'S HILL, INDIANA.

On subjecting a dilute solution of arterial blood to spectroscopic examination, certain parts of the spectrum of natural or artificial light will be absorbed.

The amount of this depends upon the degree of concentration of the blood ; if a one per cent or two per cent solution be used, two narrow dark bands are seen in the orange-yellow between the Frauenhofer lines D and E, the one next to E being a wider, but not so deep a band as the one next to D. A little of the red is absorbed and the violet indigo, and a part of the blue. This is the spectrum of Oxy-Hæmoglobin.

If arterial blood or venous blood which has been shaken with air be treated with some reducing agent such as ammonium sulphide or alkaline iron sulphate with tartaric acid, a decided change occurs in the spectrum. Instead of two bands only one appears, which is between the two lines of Oxy-Hæmoglobin, and is much broader than either of the bands mentioned above. This is the spectrum of reduced Oxy-Hæmoglobin or simply Hæmoglobin.

METHÆMOGLOBIN.

The spectrum of Methæmoglobin is obtained by first preparing Oxy-Hæmoglobin crystals by treating dog's blood with ether and shaking it until it becomes laky, then allowing it to stand in a cool place for an hour or so, at which time a firm mass will be formed, due to the crystals. The mother liquid is separated from the crystals by filtering through muslin or linen, squeezing the mass so as to obtain the crystals in as pure a form as possible. The crystals are dissolved in distilled water and a dilute solution is examined with the spectroscope. The two bands of Oxy-Hæmoglobin appear. A few drops of potassium permanganate are added and the solution gently warmed. If sufficient time has elapsed for the oxidation of the Oxy Hæmoglobin, the two bands will have disappeared and instead a single band in the red near the line C between C and D. Nearly the entire spectrum is absorbed. Sometimes it is a little difficult to get this band, but if the oxidation has taken place it will be seen. In the experiment at hand I left the solution until the next day, before it would give the above result.

CARBON–MONOXIDE HÆMOGLOBIN.

If coal gas be passed through blood which has been defibrinated, it will assume a cherry-red color, the carbon-monoxide of the gas having driven off the oxygen of the Oxy-Hæmoglobin and taken its place. The reducing agents have no influence upon this new substance, it being more stable than Oxy-Hæmoglobin. The two absorption bands are nearer to E than in the Oxy-Hæmoglobin spectrum.

HÆMATIN.

The red corpuscles are composed of a proteid stroma and a brownish pigment which is called hæmatin. The iron is a part of the hæmatin. It can be obtained either as the acid hæmatin or the alkaline hæmatin.

In making the acid hæmatin, I took 100 cc. of 95 per cent alcohol and added 2cc. of sulphuric acid, and then 10 cc. of blood ; the mixture was boiled for about an hour in a flask tube three or four feet long so that the vapor passing off would be condensed in upper part of the tube and flow back into the flask.

During this process a precipitate is formed which is acid haematin. The solution is filtered and the precipitate is dissolved in alcohol and then examined. Since the precipitate is soluble in alcohol, that which is obtained by filtering does not represent all the haematin, for a part would be dissolved while boiling. The spectrum has one broad band near C. Most of the remaining portion of the spectrum is also absorbed.

If 95 per cent alcohol be added to blood and a small quantity of caustic soda, a still different spectrum is obtained. This is the alkaline haematin spectrum. It is similar to the acid haematin except the dark band is near and often on D.

Announcement of the Toledo Meeting of The American Microscopical Society.

BY E. W. CLAYPOLE.

AKRON, OHIO.

The annual meeting will be held at Toledo, on August 5, 6, and 7. The Microscopical Society of that city have taken up the matter very cordially and intend to do their best to make the visit and the meeting both pleasant and profitable.

The members outside of Toledo are asked to do their part to secure the success of the meeting by their presence if practicable, or, if not, by sending contributions to be read. Short notes on methods of work, notices of observations, details of experiments are all of value and will be welcome.

There is an interesting field for the existence and activity of this society in this country and the recent advance of microscopical investigation all along the line has enlarged its scope for the worker. There is abundant material waiting to be worked over which can supply endless subjects for discussion. The demand for microscopical knowledge and proficiency in the medical practitioner at the present day is so great that few among the older members of the profession can keep pace with the requirements and one of the best methods of keeping in touch with the advance of the medical art on the part of the younger men is the maintenance of a connection with such a society. They can thereby become acquainted with methods, men, and learn from time to time in what direction and by whom their field of labor is being enlarged.

To the teacher, too, membership is invaluable. The peripatetic nature of the society which holds its meetings in different places year by year brings them within the reach of different sections of the country and so reduces to some the cost of attendance. Any one, man or woman, engaged in any line of teaching which involves the use of the microscope can pick up hints enough from those whom he, or she, will meet to repay a moderate expenditure. And in the present day a teacher in any such line who is not progressive will soon become a fossil.

Persons desirous of joining the society either as active workers or as learners are requested to send their names to the Secretary, Dr. Wm. C. Krauss, of Buffalo, N. Y., to Mr. Magnus Pflaum, of Pittsburgh, Pa., or to the President, Dr. E. W. Claypole, Akron, Ohio.

The subscription is two dollars yearly with an entrance fee of three dollars, in return for which a member is entitled to a copy of the proceedings containing the papers read at the annual meetings.

Analysis of the Raised Coast Period Clay.

BY ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

The analysis of the raised coast period clay was made by Prof. B. Silliman and published by Prof. J. W. Bailey in a paper entitled : "Notice of some new localities of Infusoria, recent and fossil" (Amer. Jour. Sci. and Arts, 1844, Vol. XLVII, page 337). He examined the clay, blue clay, from New Haven, perhaps the same as the Quinipiac marshes, in which W. A. Terry has described the Diatoms. Being used as a fertilizer, an analysis was made. When magnified it is found to contain particles of quartz, hornblende and feldspar derived from the rock granite of the Green Mountains which were brought down when it was formed, in the glacial period. There were seen the following diatoms :

> Actinocyclus senarius.
> Coscinodiscus excentricus.
> "   oculus-iridus.
> Cocconeis oceanica.
> Dicladia   ?
> Eunotia westermanni.
> Galionella (Melosira) sulcata.
> Grammatophora oceanica.
> Pinnularia perigrina.
> "   lyra.
> "   didyma.

These are all Naviculas now, for I quote Bailey's original list.

> Raphoneis rhombus.
> Tesselo catena.
> Dictyocha specutum.
> "   fibula.
> Spongioliars caput-sepertensis.

The analysis was :

Silica............................. .58,633
Alumina......................... .30,563
Oxide of Iron..................... 6,186
Carbonate of Lime.... 4,263
Magnesia........................ 0.705

100,350

So it is an aluminium and iron silicate. When we compare the analysis of this clay with other Infusorial clay, as at Richmond, Va., Monterey, Cal., etc., and with the diatom ooze of the Atlantic and Pacific oceans, they are found to be essentially the same. I should style it a good mineralogical species and should be disposed to name it Collonite, not crystaline of course but formed from the water, marine or peat, from which it was thrown down.

Microscope Slides of Vegetable Material for Use in Determinative Work.

BY JOHN S. WRIGHT.
INDIANAPOLIS, IND.

In the determination of plants it is frequently necessary, or at least desirable, to make examinations of various organs with the aid of a lens. Seed markings, glandular structures and many portions of the flower upon which determinations are partly based may be so minute as to necessitate slight magnification for satisfactory work. For example we have in the Euphorbias and Lobelias, many species in which the seeds are to the naked eye mere granules, but under a hand lens, their surfaces are seen to be decidedly marked with irregular ridges and pits, or are handsomely sculptured. Many leaves contain glandular structures or are covered with hairs or scales which can be best seen under the lens. In determining specimens on which such structures exist and are of value in classification, it is often desirable to compare them with like material from well determined herbarium specimens. Commonly the material for these

comparisons is dug out of or cut off the herbarium speci-
men as it is needed from time to time and placed
loosely under the lens for examination, and after it has
served the purpose of the moment is brushed aside and
lost or at best preserved in packets upon the sheet with
the specimen from which it was taken. This method is
mussy and eventually impairs the mounted specimens of
an herbarium, and where there are many workers it is
not economical of time. To avoid this is quite practica-
ble through the preservation of all such materials dry in
cells upon glass slips as opaque mounts for the micro-
scope. The cells are built by gluing to the glass slips
brass rings, and the specimens are enclosed by cement-
ing to the top of this ring the ordinary circular cover
glass. The method of building this form of cell was
suggested by Dr. Griffiths some years ago and is quite
familiar. A cell of this form will not accommodate
leaves and some other plant structure as well as another
form of cell, which is made by gluing a rectangular
frame cut from cardboard to the glass slip. A cell of
this construction will contain small leaves entire or the
tip and basal portions of the larger leaves, which can be
viewed from either side. A cell of this type must be
enclosed by a rectangular cover-glass. A supply of slips
upon which cells of various sizes have been built, may
easily be kept on hand, and whenever it becomes neces-
sary to remove from an herbarium specimen material for
examination, it may be placed in a cell in manner best
adapted for its display, labeled, and you have at once,
at very small expense, a slide of vegetable material
which will be ready for use at any future time; and, if
such a collection of slides is properly classified and
arranged, it forms a working adjunct to the herbarium
of much value, and, besides, provides one constantly
with available material for numbers of demonstrations
in botanical work.

EDITORIAL.

Postal Club Notes.—We are indebted for many of the items in this issue to the report of the Club which is printed and circulated privately among its members. We could save the Club expense and gratify our subscribers by printing its entire report for it once a year or better two or three times per year.

John C. House, of Troy, N. Y., who died January 22, 1897, was a man of gentle and refined nature, quiet habits and agreeable manners, of good heart, good sense and good will, a gentleman of the old sort, whose presence was ever a pleasure and an aid to his friends. May we see more of his like, again ! He was a business man of professional instincts, whose leisure time was largely spent, with evident pleasure, in microscopical and astronomical study. He was for ten years secretary of the Troy Scientific Association, his last public act being the attendance at the last annual meeting of the Association, and taking rough minutes of the meeting which was to have commenced his eleventh year of service, but which his sudden death prevented his writing out. He was a member of the Club for eleven years, and most of the time in charge of one of the home-circuits in Troy; and notwithstanding the feebleness of advanced age, he was was one of the most careful, trustworthy and efficient members. In the note book of the last box that reached him, the date of its receipt was carefully entered in his handwriting, though he lived not long enough to reach the three days' time at which he should, and would, have forwarded it.

MICROSCOPICAL APPARATUS.

An Oblique Light Illuminator.—When using light for illumination, oblique to the axis of the microscope, it is found that about 150 degrees is the best angle to put it at. Less than that does not bring out the fine markings on the Pleurosigma angulata, for instance, and more than that, is more than the objective can stand so that the color results.

But a simple and efficient oblique light illumination is desirable. It is made in the following manner : A piece of glass rod such as is used by chemists for stirring solutions, ¼ inch long and about ⅛ inch thick is taken and the round side ground down on a whetstone so that the ground part is rather fine. This can be accomplished by using a whetstone with a fine grain. The rod is ground down about one-third—about two-thirds are left. We have then a lens with parallel sides. It is cemented, the ground side uppermost by means of a solution of Gum Thus in alcohol and colored blue to a glass slide. The blue is imparted to it by means of a blue dye such as is sold by chemists and is an aniline dye. It is used downwards, the object glass to be viewed is placed above it and wet between them by means of Oil of Cassia. This allows the light to pass through and at the same time alters the refractive angle so that an oblique ray can enter. At the same time the light is colored blue, a color that is pleasant to the eye and at the same time objects seen in it can be seen with distinctness owing to the peculiar color. The light is a kerosine lamp and the mirror is a concave one placed at an angle of 150 degrees to axis of the microscope. I find this illumination is very practical and brings out the markings on fine-lined objects or "beaded diatoms" nicely. It is easy to make. If tried by some reader will he let the results be reported? — A. M. Edwards, M. D.

MICROSCOPICAL MANIPULATION.

Bacillus of Diphtheria.—In examination of stained bacteria, use all the illumination you can obtain. Sunlight is best. Use Abbe condenser without a diaphragm, or with the largest opening of an iris diaphragm. A 1-12 oil immersion is necessary to clearly distinguish.

No objective yet made will bear this treatment and give critical image.

Gummy Media.—I once made some very satisfactory mounts of Algae, etc., in peach tree gum dissolved, or,

more properly, softened in acetic acid. I think there is a fine field for experiment, for anyone who has the time in devising an aqueous gummy medium, applicable especially to unstained vegetable mounts.   C. M. VORCE.

Molasses as an ingredient of the Cell was formerly used to prevent cracking ; but it proved a mistake which caused the loss of many fine slides, as in all cases black spots appeared sooner or later.

The best cell I know of for balsam mounts is made of Le Page's glue and some insoluble water color. They dry in an hour or two after being made, and will hold forever.
                                                  D. B. WARD.

Are the very small black particles that form these spots evolved from the chemical constituents of the molasses, or are they from the bone-black filters used in its manufacture? LePage's glue is probably glue or gelatin dissolved in a strong solution of borax, and, if covered externally with a good water-proof finish, it would seem to be permanent.   S. G. S.

BACTERIOLOGY.

Fossil Bacteria.— M. B. Renault has long worked at the identification of bacteria found in geological strata, and now publishes the general results of his observations in a paper illustrated with a large number of drawings. As might be expected from their simple structure, bacteria appear to have been coeval with the first appearance of organic life on the earth, the coccoid form being apparently earlier than the bacillar. Indications of their presence are found in bone, teeth, scales, and coprolites, as well as abundantly in vegetable tissues. Spores and sporanges of ferns appear to have been especially subject to their attacks. The species are, as a rule, distinct from those at present in existence.—Ann. des Sciences Naturelles.

Bacterial Diseases of Plants.—Dr. V. Peglion describes in Malpighia a disease which attacks the stem of the hemp, causing disintegration of the tissues. It appears to

be produced by an organism of the nature of a bacillus embedded in mucilage, and very closely resembling B. cuboniana, a parasite of the mulberry. In Bulletin, No. 12, for 1896, of the Division of Vegetable Physiology of the U. S. Department of Agriculture, Mr. E. F. Smith states that several species of Solanaceæ—the potato, tomato, and egg-plant, Solarium melongena,—are attacked by a disease which he calls "brown rot," due to a hitherto undescribed parasite, which he names Bacillus solanacearum. It closely resembles B. tracheiphilus and the form known as "Kramer's bacillus," but differs in several characters from both. In the Revue Mycologique for 1896 M. E. Roze has described several bacteria which cause diseases in the cultivated potato, viz., Micrococcus nuclei, imperatoris, pellucidus, albidus, and flavidus. He says that M. pellucidus is always found associated with the "scab."

BIOLOGICAL NOTES.

Size of Stained Blood-Corpuscles.—My experience has been that human blood, or any non-nucleated blood, appears best when unstained. It may be an optical illusion, but I cannot escape the conclusion that staining reduces, in some manner, the size of the corpuscles.

When stained on the slide by the process of Dr. Moore, as these corpuscles were, there is no change of size produced by the staining. The coagulable matter of the blood and of the corpuscles becomes fixed, so to speak, by the drying process, and while permeable to aqueous fluids does not swell up, nor does it, on the subsequent drying, contract beyond its original dimensions when first dried. I have tested this by many measurements, and while there is sometimes a minute variance in the measurements, it is no greater than ordinarily occurs in successive measurements of the same corpuscle, stained or unstained. Dr. Moore tested this by measuring dry corpuscles, then staining them and remeasuring the same corpuscles which were identified by their relation to certain marks on the slide. I have slides of blood, spread at a single sweep and

stained on one half of the smear, leaving the other half unstained, in which measurements of a given number of corpuscles, taken as they come, from each part, give identical results.   C. M. VORCE.

Crystals in Blood Corpuscles of Frog.—I have a slide prepared by the process of the late lamented Allen Y. Moore, M. D. The blood was spread on slide, and dried; flowed with aqueous sol. of eosin, and washed; flowed with aqueous sol. of methyl blue, and washed, dried, and mounted in balsam.

The blood of fishes, frogs, and perhaps other reptiles, often exhibits crystals apparently within the corpuscles when simply dried without staining. This has been noticed by many observers.

These elliptically formed crystals are not in the same plane as the corpuscles, and seem to be on the cover-glass. It is the custom of some to cleanse the covers in an acid solution, and then rinse in alcohol. If this was done, the cause of the crystals being there might be from an insufficient washing after the acid bath. If a few drops of a saturated solution of any of the salts in water be dropped into a little alcohol, the salt immediately crystallizes into individual crystals such as are seen in this mount. I have had slides showing crystallization in film so thin as to be seen only by polarized light, which I attributed to an insufficient washing after soaking in a cleansing bath of borax solution ; and I believe that if they had been rinsed in alcohol it would have produced individual crystals and not a thin film.   THOS. J. BRAY.

Larvae of Clothes Moth.—These larvae are very small at first ; the body is white and soft, and seems to need the protection of the tube or case which it builds from the woolen fibres cut small and cemented together. My specimens were taken from a fancy worsted crocheted mat, of no earthly use, and consequently somewhat neglected; the dyed wool as utilized by the insect makes a pleasing object. The six anterior feet of the larvae are strong and can drag the caterpillar and its case along in this fashion : the body

is thrust out ahead, and the case is dragged up to it and adheres by its roughness until the body can be again thrust forward about half its length, when the case is again "hitched" forward. The masticated wool may be seen in the intestine ; the pieces are liberal in size, which seems to indicate a very robust digestible tract. A mass of stored up fat may be seen at the posterior extremity of the body. This worm is able to make muscle, fat, blood and moisture out of the dry wool fibres.   S. G. S.

Bog Moss Leaves. The bog mosses are widely distributed in cooler climates, being the chief source of peat and turf deposits. They keep moist for very long periods, preserving the water in the bogs when the surrounding country is completely dried up. The cells of the leaf are of two kinds: (1) narrow elongated cells filled with chlorophyll, the so-called ducts, and (2) large empty cells stiffened by spiral or annular thickenings, and perforated by large pores which communicate with the exterior. These large cells are called the utricles; they retain the water for a great length of time, and serve as homes for various worms, rotifers, amoebæ, etc., some of which may be seen in a slide.   A. P. BROWN.

Statoblasts "winter eggs" of Pectinatella.— These are not eggs, since they cannot be traced to a single cell. A statoblast is formed by the separation of a mass of cells within the tissue of the Bryozoan ; this mass cannot be traced back to any one cell, hence it is not an egg, or a developing egg, but is to be regarded morphologically as a bud, an internal one to be sure, which surrounds itself with a thick double cellular coating, and passes the winter in this shape. The statement in most text-books that the statoblasts are parthenogenetic eggs has been absolutely disproved. If at the time when they are beginning to form, transverse sections be made, of the colony, these cell masses may be clearly made out in the funiculus, and the stages in their formation may be followed.

                                    HENRY B. WARD.

The Water Mites (Hydrachnidae).— These acquatic

members of the order Acarina are easily secured and pre-
served either alive as aquarium objects which will prove
very interesting with their brilliant colors, odd forms and
lively dispositions, or preserved with a corrosive subli-
mate solution, or in a mixture of glycerine, 2 parts, absolute
alcohol 1 part, 2 per cent acetic acid (glacial) 2 parts, and
distilled water 3 parts.

The writer will gladly give any aid in this study to those
requesting it, either through identifications, or hints about
collecting and studying the group.   He will also deem it a
great favor if any observer who secures the specimens but
does not care for them will forward them to his address :
or, if desired, he will collect in other groups in exchange
for water-mites.   Robt. H. Wolcott, Lincoln, Neb.

DIATOMS.

Diatoms from Redondo Beach.— The bed upon the
Pacific coast, 18 miles south-west from Los Angeles, Cal.,
from which this deposit was obtained, occurs at points
from Redondo northward to Monterey and possibly farther.
It has not always been found as rich as this waif, nor as
the deposit in situ at Redondo.

This bed may be considered the counterpart of the
great fossil diatom bed buried beneath the Atlantic coastal
plain from New Jersey southward.   The geological age of
the Atlantic bed is now well known to be Miocene.   The
age of the Pacific coastal bed the writer has not as yet been
able satisfactorily to ascertain, but it is probably either
Miocene or Pliocene.   The Atlantic coastal diatom bed
dips very slightly and regularly toward and under the
ocean; the Pacific coastal bed has been disturbed and up-
heaved from its original position, and sometimes dips quite
steeply and nearly vertically, though generally also toward
the ocean it borders.   Lewis Woolman.

Distribution of Diatoms.—Diatoms are found in both
marine and fresh waters, the specific forms being mainly
different in each.   Both marine and fresh water diatoms
occur in the fossil state.   They frequently form a consid-

erable component part of beds of great thickness in past
ages. Beneath the Atlantic coastal plain there has been
continuously traced a marine Miocene bed from Asbury
Park, N. J., to Richmond and Petersburg, Va. It out-
crops along the deeply-cut creek banks about Richmond,
and underlies the town. It occurs between the depths of
16 and 95 feet at Asbury Park, between the depths of 400
and 700 feet at Atlantic City, N. J., and between the depth
of 400 and 800 feet at Crisfield, Md. Its maximum thick-
ness, so far as yet known, is therefore 300 to 400 feet. At
Richmond, however, it is but about 25 feet thick.

A fresh water deposit, of Pliocene age, underlies the
Llano Estacado or Staked Plains of Texas, an area several
times larger than Pennsylvania.   LEWIS WOOLMAN.

MICROSCOPICAL NOTES.

Crystals from Muller's Fluid.— As an object for the
study of embryology, this slide [of fetal tissues hardened
in Muller's fluid, and mounted through clove oil into ben-
zole-balsam] is good ; but look at it with your polariscope
and tell the rest of us what these beautiful crystals are,
which stud the entire surface of the mount. They evi-
dently do not belong to the fetal hand, for they are diffused
throughout the mounting fluid. If the preparer, after
hardening in Muller's fluid, omitted to wash out the
bichromate of potash from his object, these needles are
bichromate of potash crystals. They have a somewhat
rhombic form, which is what would be expected.

H. M. F.

Sonorous Sand from Hawaii.—The present writer has
recently received from Dr. Benj. Sharp, who, with Prof.
Libbey, visited the Sandwich Islands during the summer
and fall of 1893, some of this same sonorous sand. It was
obtained from a dune facing the beach upon the island of
Kauai. Geologically the island is the oldest of the group,
having been first formed; it is the only one of the islands
on which dunes occur. All of the islands are of volcanic
origin.

This sand is mainly composed of minute worn fragments of molusks. In that received by the writer there occur a considerable number of foraminifera, some quite perfect but most of them much worn. On treating the sand to hydrochloric acid, so as to dissolve the calcareous material, about 1-25 of the original bulk remained. This remainder is evidently chiefly composed of small, worn, sand grains, derived from the volcanic rocks of the island ; it contains a few, very few, marine diatoms.

Sands which emit sound when their particles are rubbed together, as when trod upon, are not infrequent, and are not confined to calcareous sands. The writer has noticed them in the siliceous sands on the beach between one and two miles south of Beach Haven, N. J. None of these sands emit sounds when wet ; to do so they must always be dry. They are locally called by various names, as sonorous, sounding, barking, musical, and æolian sands. Alexis A. Julien has written an elaborate paper upon "Musical Sands."   LEWIS WOOLMAN.

Section of Chalcedony.—Silica, SiO_2 , occurs in nature mainly in two forms, (1) crystalline and anhydrous as quartz, and (2) amorphous and hydrous as opal. Chalcedony is generally described as a crypto-crystalline variety of quartz ; that is to say, while it is essentially crystalline in structure, the individual crystals in the mass are too small to be distinguishable. It is usually found forming crusts and lining cavities or cracks in rock, and is a secondary mineral formed by the deposition of silica in successive layers, this taking place so rapidly that there is no opportunuity for the formation of distinct crystals of quartz. No doubt in many cases the silica thus deposited is largely gelatinous when first precipitated, but a crystallization soon takes place, so that in the mineral as usually found there is not very much opal in proportion to the crystallized portion. The crystallization proceeds from centre in a radial manner, so that the surface takes an irregularly rounded form which is described as botryoidal or mammillary. Between these minute crystals there is generally

more or less opal or uncrystallized silica which contains water, so that analysis shows that chalcedony contains from 0.3 to 2.5 per cent or more of water.

In this section, when examined in polarized light, the needle-like radiating crystals of the quartz are seen to form circular areas, in which the successive layers of growth can be well seen. These areas represent in section the rounded elevations of the free surface. Each circular area is composed of a very great number of crystals, which give it the radial character. These areas interfere with each other more or less, but an examination of their concentric banding as seen with the polariscope enables one to trace out the different stages of the formation of the mineral. At the edges representing original free surfaces some well-formed crystals of quartz have developed and encrust the edge of the section. The same region shows the enclosure of foreign matter, giving a banded appearance in ordinary light. This is essentially the structure of agate, which is simply banded (and generally colored) chalcedony. Carnelian or sard is likewise a variety of chalcedony of a red or yellow color (not banded).

<div align="right">Amos P. Brown.</div>

NEW PUBLICATIONS.

Biological lectures delivered at the Marine Laboratory at Wood's Holl. Ginn & Co., pp. 188; constitutes a very interesting volume.

Microscopic Internal Flaws inducing Fracture in Steel. By Thomas Andrews, F. R. S., F. C. S., M. Inst. C. E., etc. 8vo, pp. 52. (London : E. and F. N. Spon. 1896.)

A paper of considerable importance to Civil Engineers, reprinted from Engineering, on Microscopic Internal Flaws in Steel, Railway Locomotive and Straight Axles, Tyres, Rails, Steamship Propeller Shafts, and Propeller Crane Shafts, and other Shafts, Bridge Girder Plates, Ship Plates, and other Engineering Constructions of Steel. There are 30 micro, figures showing internal defects.
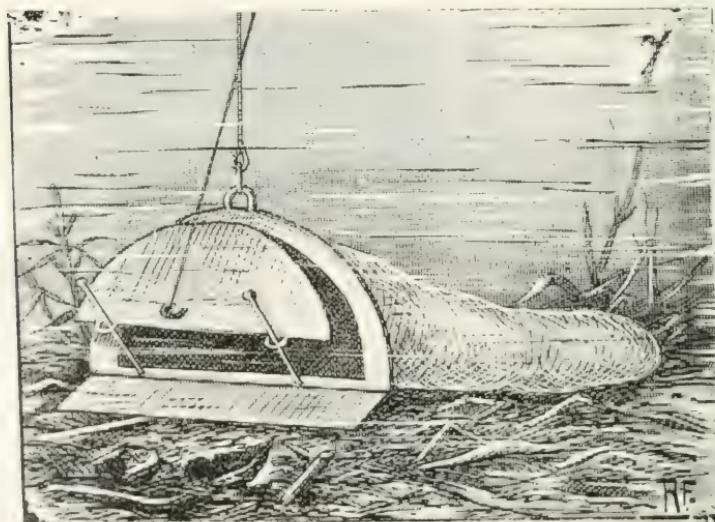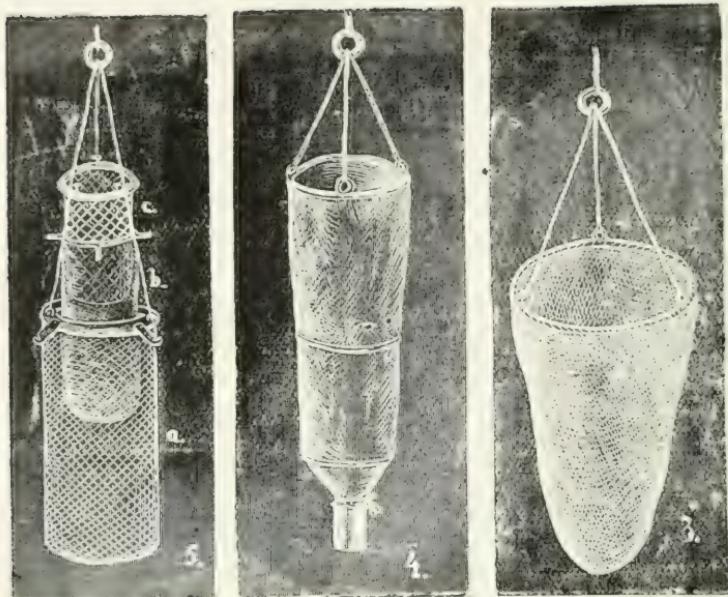
COLLECTING APPARATUS.

Some Collecting Apparatus.

By Dr. E. v. DADAY.

BUDAPEST, HUNGARY.

WITH FRONTISPIECE.

If we take some water in a clean glass vessel from the body of a lake and examine it attentively, holding it towards the light, we shall find in most cases that there are in the water, although apparently quite clear, small bodies and living beings of molecular minuteness swimming about, each in its own way. There was a time, not very remote, when students of the microscopic world contented themselves with examining each drop of the water drawn from a lake, with a magnifying glass in order to find the small animals in it. By such a proceeding we are in most cases left to chance. It is mere luck if we find something in the water. The naturalist desirous of getting thoroughly acquainted with the microscopic fauna of a lake cannot stop at this point, but ought to recur to such expedients as will assure him of the absolute perfectness and success of his researches. He must provide himself with suitable implements and they are numerous. He must at the same time provide himself with the means of conservation. For collecting specimens of water-fauna, we make use of a net. Considering the extreme minuteness of those beings we have

to deal with, all these nets must consist of the finest silk-cloth, called miller-gauze, but they must be of different fineness, according to whether they are used for collecting on shore, in open space, at deeper levels or on the bottom of a lake.

The best and handiest implement for collecting from the shore is the rod-net, which we may easily construct
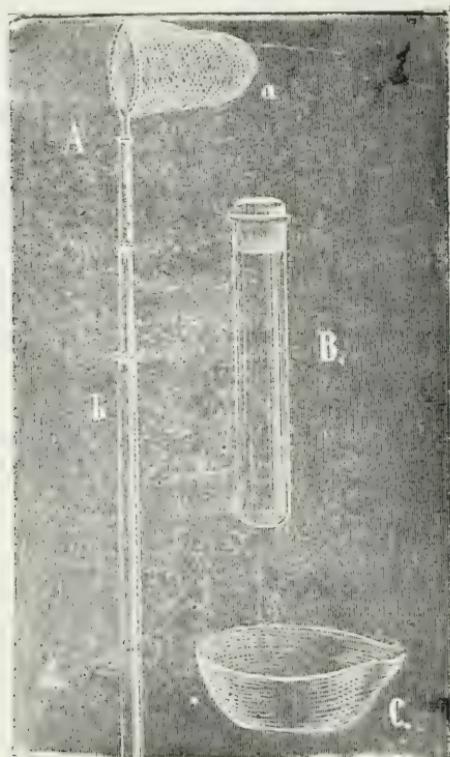
ourselves by taking a brass, or still better an iron, ring and sewing on a bag of the above mentioned gauze. Then look for a stick of fitting length, cut it at its end and fasten the ring by tying it with a string. But there are several other rod-nets, which are not only practical regarding their form, but also easily managed.

A rod net commonly used, is represented by fig. 1, A, and consists of two different parts, viz., the net (a) and the rod or handle (b).

The net hangs from a brass or iron circle, provided with a small copper-tube, perforated on two opposite sides.

The rod or handle consists of three copper barrels, which slide one into the other, each of which is 1 to $1\frac{1}{2}$ mètres in length. The upper barrel has on its end a cover, from the centre of which a perforated clasp projects, which fits exactly in the copper-tube of the net ring. Being able to lengthen and shorten this rod as one pleases, we are relieved from the need of carrying with us a pole or several shorter sticks. The clasp on the end of the thinner rod and the tenon of the ring enable us to fix the net easily, while a pin put through the two holes prevents its slipping from the rod.

Collecting with this apparatus is very simple. We fasten the net to the rod by aid of the tenon and then we pull out the sticks and begin to draw water as if we were using a spoon. The water by this means is strained. The greater proportion of the animals, and, if our net is sufficiently fine, even the smallest organisms are retained.

To bring home the gathered material.— For this purpose a collecting bowl or basin of china, fig. 1, C, or some other material, and having a large gullet, may be used. Having filled this bowl with water before beginning the operation the contents of the net are washed out at intervals. At the close of collecting, strain the whole contents of the bowl through the net and substitute the water in the bowl with alcohol or any other preservative liquid.

The material thus prepared is finally poured into a glass tube (fig. 1, B) to be closed by a cork. On a small label note with a pencil the place of collecting, the so-called habitat : the time of collecting, the month, day,

and eventually the hour. Then put the label to the material in the tube. It is necessary to lay stress on this in order to avoid confusing materials found in different places; we may easily expose ourselves to error if collecting from different localities or from different parts of a lake.

Another kind of rod-net, not less commonly used is represented in fig. 2. It differs from the other chiefly by the funnel-like form of its net which is not closed but open, so that a wide and thick-sided cylindrical or other glass may be tied to it with a thick string (a). According to this, its rod must be much stronger than that of the former, because the water contained in the glass vessel is of considerable weight and therefore we employ instead of the pretty elastic copper-barrels, thick bamboo sticks or pine-poles, to which the net may be fastened in the same way as formerly described (b). The use of this contrivance is nearly identical with the former, the only difference consisting in that we are not obliged to fill the bowl with water. The glass untied from the net, encloses already the required quantity. But the frequent tying and untying of the glass renders the whole proceeding a little dull and tiresome in comparison with the other without glass-bottom.

If we want to collect in the open lake, a boat or any other water-vehicle being at our disposal and intending only to examine the upper layers of the water, we might use rod-nets: but if we have in view to collect from deeper layers we are obliged to use so-called drag nets.

The simplest drag-net is a bag of silk-tissue fastened to a brass or iron ring. The brim is provided with three ringlets at an equal distance, in order to attach the line to it (fig. 3.) If we are on the open lake, our net may be lowered unto the required depth and at the same time towed by the advancing boat. During this operation the water filling the net is strained, while the organisms in it are retained by the fine tissue and may be secured in the way formerly described. With this contrivance we are enabled, provided our line is sufficiently long, to reach the bottom of the lake and may even bring up mud from the bottom. If we have no boat at our disposal and still want to collect from parts which are a little distant from the shore, then we put some stones, or other heavy object into the bottom of the net, throw the latter into the water and endeavour to get the desired material by slowly pulling the net to the shore.

Another kind of drag-net is due to the Bohemian Biological Institution. It reminds us in its general out-line of the former, but is still different in many respects. Like the former it possesses a brass or iron-ring with ringlets for tying on the line, but its bottom is open. Here a glass-vessel is to be fastened as mentioned in description of the rod-net. This net, judging from its shape, consists of two parts, viz., a larger cylindrical one and a smaller funnel-like one, separated by a hoop of reed, sewn in. In the middle of the cylindrical part is also a hoop of reed. (fig. 4.) These hoops lessen the specific weight of the apparatus. The Bohemian searchers employ still another, funnel-like, open net provided with a reed-hoop, which is put in the space of the larger net and is apt to prevent material already in the large net from being washed away by the water flowing back. This precaution is superfluous, though, if in dragging the net necessary care is taken and the required time is given to strain the water. This implement is applicable only

when we can transport ourselves to the open space of the lake and on account of the reed-hoops it may only be used for working at the surface of the water. The material collected is subject to the same treatment, the bottom glass being applied, removed and emptied—as in the case of rod-net described in the second figure. Its use is therefore not so advantageous and multifarious, as that of the simple bag-like drag net.

In its principles of construction the net used at the Biological Station of Plon, called the plancton net is the same, but there is not at its bottom any closed vessel. It is provided with a tap, so that its contents may be emptied into the bowl by turning the tap.

For collecting organisms living at the bottom of lakes and bringing up mud, I devised a bottom-net of which I give a design in fig. 5. The outer cylinder (a) is made of pretty narrow brass wire tissue. The bottom is either convex or flat. The brim is formed by a brass hoop of 2 cm. breadth, provided with rings for fastening the line. Besides there are three movable clasps on it.

The middle cylinder (b) is a bag of very narrow silk-cloth, sewn to a strong brass-hoop about 2 cm. in breadth. The bottom is of bag-like shape. There are three tendons standing out from the hoop, to prevent the net from sinking to the bottom or from sticking to the outer wire cylinder.

The inner cylinder (c) is made of wide meshed brass wire cloth. The bottom is closed like a bag. The brim is covered by a flat brass circle 2.5 cm. broad, and its outer circumference is a little larger than the inner one of the outer cylinder. There are three little screws placed at an equal distance one from the other, provided with eyes ; when using the net, the clasps are hooked in the screws and the eyes then screwed down. The separating and uniting of the three nets is thus rendered possible.

Each cylinder of this apparatus has another function. The outer wire cylinder is a protecting case, preventing any damage to the net and ought therefore to consist of pretty fine cloth so as to resist branches of trees, and things covering the bottom of lakes. The middle cylinder of gauze is the real collecting net, which retains organisms or slime after straining the water. The inner cylinder is intended for keeping off larger objects which would be liable to injure the fine silk gauze. It affords only protection to the inside and consists therefore of pretty wide meshes, giving easy access to water and organisms.

When working with it, we unite the different cylinders. After this the apparatus is lowered into the lake by the pulling line fastened to the rings. Then slowly advancing the boat, we tow it a certain time, until it naturally fills with organisms and slime. Having drawn out the apparatus, we separate the cylinders, by loosening the screws and take out the gauze cylinder with the matter contained in it. The conservation is then carried out in the same way as formerly described, but if there be too much mud in the net, its greater part is removed by dipping the net several times into the water.

For investigating certain fauna I have devised another dredge, shown in fig. 6., consisting of two parts, the shutting cover and the net proper.

The shutting apparatus (a) is formed by a brass frame standing somewhat obliquely, with a wide semicircular mouth. It is closed by a trap door also of brass, which may be raised or lowered. There is a small ring in the middle of this trap door near its horizontal edge, to which a line is tied. On both sides of this suspension ring there are two brass sticks with knobs on their ends; these are fastened to the frame but are movable, so that they are raised when the trap is opened and lowered when the trap is closed, sliding in the holes which are

provided for them in the trap door. The under horizon-
tal edge of the frame is provided with a scraping blade
standing out and directed a little downward. This facil-
itates the penetration of the mud through the mouth of
the frame into the net. Opposite to this and inside the
net there is another brass plate called the weight plate
on which weights are placed to increase the specific
weight of the apparatus. These weights are required
for maintaining the apparatus, when let down, in a verti-

cal position and thus they prevent the frame from lying
down by its own weight. There is a strong ring on the
semicircular part of the frame, to which the pulling-line
for lifting and lowering the apparatus is fastened.
Beside this there is a border of fine wire tissue round the
frame to which the gauze is fixed.

The net (b) is conical; and consists of fine gauze. It is
fastened to the border of wire tissue surrounding the
backside of the frame.

The apparatus is carefully let down by the aid of the
rope. At the same time the rope which is fastened to the

trap-door is also let down. The trap remains closed until the bottom is reached. When the apparatus has reached the required depth, then we pull the rope of the trap-door and thus open it ; the tightness of the rope which before was loose will inform us of the success. Then we must give our boat a slow impulse and drag the net along as fig. 7 shows. The water with all its organisms and the mud tilled up by the scraper, will then fill the dredge. Before drawing out the net, we let loose the rope of the trap door, thus closing it ; no other material can thereafter penetrate into the net. The exact closing of the trap is furthered by the two brass-sticks. According to their length they allow the opening of the trap only to a certain height, viz., to about 20-25° to the upper board of the frame not in a vertical position. Thus the closing of the trap-door is not only due to its own weight, but also to the pressure of the water. After drawing up the net, the trap door is opened, the net turned inside out and the material washed into the bowl. According to the directions already given, it is then put into the conserving liquid and finally into the cylindrical glass.

The attention of naturalists is called to a great advantage which this net possesses over the drag and bottomnets hitherto described. It enables him to undertake the exact determination of species living in different levels of water. With this implement, the opening of its trapdoor being under control, we may collect our material at depths corresponding to our desire and state exactly the presence and migration of such and such species. We may determine in which masses or swarms they occur, during the different parts of the day ; even the hour and the different depths in which they wander.

We have also to equip ourselves with certain other necessary things. It is very convenient to use a hunter's pouch. In the place of the cartridges we put our glass tubes and in the pouch itself the bowl and smaller nets.

The material gathered from different parts of the lake by means of any of this apparatus ought to be conserved each in a different way. If only the outward habitat of the different animal species forms the object of our study, then it will usually be sufficient to put the material in alcohol of 30-50°. This proceeding leads to a satisfactory result only when we have to deal with animals of greater resistance, such as rotatoria, crustacea, nematoda and protozoa. On the contrary, animals with a soft body, as protozoa with a thin shell and tubellaria as well as those with a harder shell must, if we want to examine them anatomically, be treated with certain chemicals before placing them into alcohol. The treatment with sublimate gives in every respect good results. We pour a solution of sublimate over the material filtered out and into the water containing the material. By this means the animals are killed suddenly, but their texture is conserved to a certain degree. This being done, we filter the sublimate or water containing the sublimate and substitute alcohol first of 30°, then of 50° and finally of 70°.

Bacteriology of Influenza.

By J. D. WHITLEY, M. D.,

PETERSBURG, ILL.

A number of Bacteriologists have made careful researches during the extensive epidemic of 1890, 1891, and 1892. In 1892, a bacillus was discovered by Pfeiffer and by Canon of Berlin, which according to Sternberg, there is good reason to believe is the specific cause of the disease.

Pfeiffer infers that this bacillus is the specific cause of Influenza in man for the following reasons: First. They were found in all uncomplicated cases of Influenza examined, in the characteristic purulent bronchial secreion, often in absolutely pure cultures. They were fre-

quently situated in the protoplasm of the pus corpuscles. In fatal cases they were found to have penetrated from the bronchial tubes into the peribronchial tissue and even to the surface of the pleura, where in two cases they were found in pure cultures, in the purulent exudation.

Second. They were found only in cases of Influenza. Numerous control experiments proved their absence in ordinary bronchial catarrh, etc.

Third. The presence of the bacilli corresponded with the course of the disease, and they disappeared with the cessation of the purulent bronchial secretion.

During the past winter I have made a careful examination of the sputum in a number of cases of moderate severity and found a very constant form of bacteria which answers to the morphological description.

That the specific exciting cause of Influenza is organic in its true nature and also that the air constitutes the medium of its dissemination there can no longer be any doubt. There is also good reason to believe that an incubative stage covering a period of two or three days is necessary for the development of the disease. The micro-organisms are introduced into the upper air passages, and here finding a lodgment, develop upon the epithelial cells where they occur in pure cultures ; they are then drawn into the bronchiæ by inhalation giving rise to the characteristic sputum, the cough and expectoration following in many cases after the patient has recovered from the initial symptoms.   In this type of the disease little else is shown by a microscopical examination than the above mentioned bacilli. But in the graver type the picture is quiet different and the severity of the attack is evidently due to a mixed infection. Here we have evidence of a local disturbance by the great quantities of bronchial epithelia which are thrown off the round cells, are very abundant, and also columnar cells, and often red blood corpuscles. White pus cells are very numerous,

together with the streptococcus pyogenes aureus in almost
pure cultures. The pneumococci are found in large
groups in almost every examination of this type; and
last, but not least, we find that formidable ally strepto-
coccus pyogenes is very abundant. The significance of
the last named microbe may be inferred if we are to believe
that special virulence is added to other diseases by its
presence, notably in diphtheria.

The bacteria are best prepared by the "Ziehl-Neelsen"
method of staining as for tubercle bacilli, using the
Loeffler methyl blue for back-ground but giving a more
than usual exposure to the latter agent.

The indications for treatment are antiseptics, elimin-
ants, anodynes, and tonics, with rest in bed. I am con-
vinced that the disease may be aborted in many cases if
seen early, by the following prescription :

> Quinia sulph.................... grs. xx.
> Pulvis doveri....................grs. xx.
> Pulvis capsici...................grs. iiss.
> Aconite Tinc..................5 minims.

M. Ft. Pills No. x. Divide. Signa. Take three at once
on retiring at night (after taking a hot foot bath); take
one every two hours the next day.

In the more advanced cases the treatment should begin
with a laxative, followed by salol in three to five grain
doses every three hours, preferably in a powder form.
This controls the fever, relieves the aching, and is a good
intestinal antiseptic. In the troublesome head pain relief
may be obtained by spraying the nostrils with camenthol
10 per cent. Codeine acts well in suppressing inordi-
nate coughs, and good results have followed inhalations
of carbolic acid with a steam atomizer where the expec-
toration was very profuse. The mouth should be rinsed
frequently and the throat gargled with a warm solution
of formaldehyde 1 cup diluted one half with warm water,

or the alkaline antiseptic tablet of Dr. Carl Seiler, one dissolved in a teacup, half full of warm water.— Medical Fortnightly.

On Rearing Dragonflies.

By JAMES G. NEEDHAM.

Field work in Entomology is full of delightful opportunities, and none is more inviting, none more sure to yield discoveries of scientific value, than work upon the life-histories of Dragonflies.

The nymphs which are aquatic, have an interesting distribution in depth. Those of Agrionidae and of most Aeschinidae cling to the floating or submerged vegetation. These at least every aquatic collector has seen. Those of Libellulidae sprawl upon the bottom amid fallen trash. Those of Gomphinae burrow shallowly along beneath the film of sediment that lies on the bottom, with the end of the abdomen turned up for respiration.

It is very easy to collect them. A garden rake with which to draw ashore the stuff to which they cling and a pail of water in which to carry them home is all the apparatus desirable in spring. Later when a new growth of weeds is rooted fast to the bottom, the rake will have to be exchanged for a water-net. Withdrawn from the water, the nymphs render themselves evident by their active efforts to get back, and need only to be picked up. The number of species one will find will generally depend on the variety of aquatic situations from which he collects. The places to yield the best collecting are
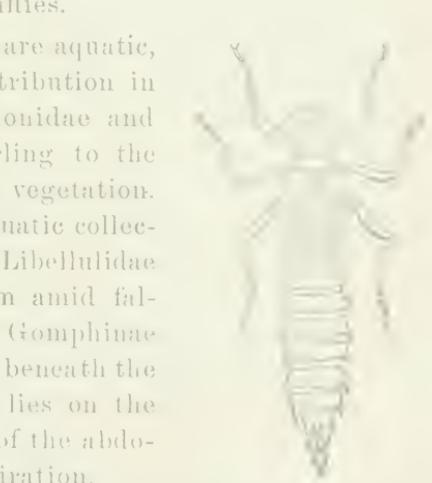
small permanent pools, shallow inlets in the shores of lakes, and the places where the trash falls in the eddies of streams.

They are quite as easily reared. Common wooden kits and pails half filled with water, with screen or netting covers are entirely satisfactory. A number of nymphs, if near one size, may safely be kept together (excepting only a few notoriously cannibalistic Aeschinidas : e. g. Anax junius), and if not grown may be fed upon such small insects as a net will gather in any pond. A good square meal once a week will keep them thriving. The water should be reasonably clean. Three things should be carefully observed. (1) There must be a surface up which they can climb to transform : if the sides of the kit are too smooth put in some sticks ; (2) there must be room enough between the netting cover and the water for complete expansion of their wings : (3) they must remain out of doors where the sunshine will reach them. This last point especially is essential to success. But there is still an easier way to do it, and one which, when a species is very common, will prove entirely satisfactory. The several nymphal stages (excepting the youngest, not likely to be collected) are very much alike. I am in the habit of preserving the younger nymphs and putting into my kits only those well grown, as shown by the length of the wing-cases, which should reach the middle of the abdomen. But if, when a species is becoming common, one will go to the edge of the water it frequents, at the time of its emergence, one may find nymphs crawling from the water, others transforming, imagoes drying their wings, and others ready to fly, and may thus obtain in a few minutes the material necessary for determining nymph and imago. The time of emergence may be determined by noticing at what time pale young imagoes are seen taking their first flight, and then going out a little earlier. The unfortunate thing about it is that

many of the larger species transform very early in the morning, and to take such advantage of them one must be on the ground between daybreak and sunrise.

Several imagoes should be kept alive until they have assumed their mature colors. It is most important that each imago and its cast skin should be kept together.

Eggs, also, are easily obtained. Every collector has seen the female of some species, dipping the tip of her abdomed into the surface of the water, depositing eggs. If the ovipositing female be captured, held by the fore wings, leaving the hind wings free, and "dipped" by hand to the surface of clean water in a vial or a tumbler, an abundance of eggs will usually be liberated. Eggs of those species which possess an ovipositor and which place them within the tissues of plants may be obtained by collecting the stems in which they have been inserted.

Eggs and nymphs should be dropped in boiling water for a minute and then preserved in alcohol. Imagoes, if mounted, should have a wire or bristle inserted into the body its entire length to prevent otherwise certain breakage, or if placed unmounted in envelopes, these should be of soft paper, loosely packed, so that the eyes will not be crushed.

Try to cover for each species the points of the following outline regarding the imago :

(1) Name ; locality ; date ; occurrence ; etc.

(2) Haunts ; places frequented ; places avoided ; the reasons, if discoverable.

(3) Flight : its hours ; its duration ; its directness ; average altitude ; places of rest ; altitudes.

(4) Food : its kind ; how obtained ; where eaten.

(5) Enemies : what they are ; and how do they destroy dragonflies ?

(6) Oviposition : does the female oviposit alone or attended by the male.

(7)   The eggs : where placed ; number in a place ; incubation period.

Regarding the nymphs, cover the points 1, 2, 4, and 5 of above, and Imagination : hours ; places ; distance from water : etc.

It is very difficult to determine all these points for a single species, but the effort will lead on into delightful intimacy with these beautiful insects.

I will furnish (if desired) half a dozen named nymphs of typical genera to any one who will undertake to collect and rear others. I shall be very willing to determine nymphs or imagoes for any one, and to point out for description such as are new. But I especially desire that accurate field observations and notes be made on many of our species of which we now known only the names, and to such observers I will give all possible aid.—Can. Entomologist.

The Myometrium.—Bertelsmann writes regarding the microscopic relations of the myometrium in pathological enlargements of the uterus, with particular reference to the muscle-cells. He has made (Archiv fur Gynakologie, Band L), a careful microscopic study of twenty-two enlarged uteri (three cases of mero-endometritis, four of carcinoma of the cervix, three multiple interstitial, and five submucous fibroid tumors). He comes to the following conclusions : Hypertrophy of the muscle-cells of the uterine wall is frequently associated with interstitial fibroids. Hypertrophy of the muscle-cells always occurs with submucous fibroids and in almost every instance where the uterine cavity contains an abnormal substance (pyometra and hematometra). Hyperplastic changes, also increase of the connective tissue and muscle-cells, were found particularly in metitis and in carcinoma and interstitial fibroids. These results correspond with those of Ritschl and Herczel, who experimented on the wall of the stomach and intestines by causing artificial stenosis and artificial irritation.

Hosts on which Infusoria are Parasitic or Commensal.

Complied from W. Seville Kent's Manual of the Infusoria.

BY THOMAS CRAIG, F. R. M. S.

NEW BRIGHTON, N. Y.

All marked * are parasitic IN their hosts, those not so marked are ON the host.

HOST	INFUSORIAN
Carchesium polypinum	Podophrya carchesi
*Paramecium aurelia	Sphærophrya sol
*Stentor roeselii	Sphærophrya stentoria
Epistylus plicatilis	Urnula epistylidis
" "	Trichophrya epistylidis
" "	Podophrya quodripartata
Cyclops quadricornis	Zoothamnium parasita
" "	Opercularia cylindratus
" "	Prodophrya cyclopum
Cyclops gigas	Prodophrya infundibulifera
Cyclops coronata	Ryncheta cyclopum
Cyclops	Vorticella globularia
Cyclops	Epistylis digitalis
Canthocamptus minutus	Lagenophrys vaginocola
Entomostraca	Pyxidium cothurnoides
"	Zoothamnium affine
"	" parasita
"	Epistylis anastatica
"	Cothurnia imbertis
"	" sieboldii
"	" curva
"	" gracilis
"	Trichophrya digitata
"	Spirochona gemmipera
"	Spirochona scheutenii
"	Epistylis digitalis
"	" crassicollis
Gammarus pulex	Anoplophrya branchiarus
" "	Dendrocometes paradoxus
" "	Lagenophrys ampulla
" "	" nassa
" "	Spirochona gemmipera
" "	Epistylis steinii
Gammarus marinus	Spirochona scheutenii
" "	Stylochona coronata
Asellus aquaticus	Lagenophrys ampulla
Physa fontinalis	Schyphidia physarum

Mollusca	Various opercularia
"	Conchophthirus anodontae
"	Epistylis coarctatae
Paludina vivipera	Podophrya elongata
Limnœus stagnalis	Epistylis plicatilis
Belanus	Epistylis balanorum
Unio crassus	Conchophthirus
Planorbis cornea	Epistylis euchlorum
Planorbis	Scyphidia limacina
Paludina	Phychostomum
Paludina	Anoplophrya vermicularia
Helix hortensis	Conchophthirus
*Mussel	Anoplophrya mytie
*Lumbricus terrestes (earthworm)	Plagiotoma lumbrici
" "	Anoplophrya striata
" "	Hoplitophrya lumbricus
" "	" falcifera
Lumbrichus variegatus	Hoplitophrya secans
" "	" securiformis
*Lumbricus limosus	Anoplophrya clavata
* " tenuis	" cochleariformis
A marine worm or annelid—	
Psyrmobranchus protensus	Lichnophora cohnii
*Marine worms	Anoplophrya prolifera
" "	Balantidium medusarum
Planarians	Trichodina digitodiscus
"	Urceolaria mitra
"	Colvoluta schulzie
"	Pulsatella convoluta
*Planarian limacina	Hoplitophrya recurva
* " torva	Hoptophrya planiarium
"	" uncinata
Planarian-thysanozoon tuberculata	Lichnophora auerbachii
· Triton cristata	Spirochona tintinabulum
" "	Trichodina pediculus
* " toeniatus	Balantidium elongatum
*Bufo pantherinus	Haptophrya gigantea
*Hyla europea	Opalina obtrigona
*Frogs & toads	Opalina ranarum
" "	Opalina dimidiata
·· ··	Opalina intestinalis
·· ··	Balantidium entozoon
·· ··	" elongatum
·· ··	" duodeni
·· ··	Nictotherus cordiformis
·Nais serpentina	Anoplophrya naidos
·Nais littoralis	" nodulata

Nais	Scyphidia inclinans
Bryozoa	Acineta pusilla
Nebalium bipes	Stylochona nebalina
*Clitellis arenarius	Anoplophrya filium
*Bombinator igneus	Opalina caudata
*Clepsine binoculata	Apoplophrya striata
*Pachydrilus verrucosa	Anoplophrya pachydrili
Hydrophilus piceus	Podophrya ferrum equinum
Neritina fluviatilis	Trichodina baltica
Sponge—freshwater	Cychochaeta spongilla
Cyclostoma	Trichodinopsis paradoxa
Tubifex rivulorum	Epistylis tubificis
Enchytroeus vermicularis	Hoplitophrya secans
*Urnatella gracilis	Anoplophrya socialis
*Medusa	Balantidium medusorum
*Human	Balantidium coli
*Moss on trees	Cyclidium arboreum
*Water beetles	Nictotherus gyseryanus
Hydroporus picipes	Podophrya wrzesniowski
Notenecta glauca	Acineta notenecta
Coleoptera aquatic	Podophrya leichtensteinii
" "	Acineta linguifera
Insects	Nictotheras ovalis
" aquatic	Rhabdostyla brevipes
" "	Zoothamnium affine
" "	Epistylis invaginatus
" "	" nympharum
Dytiscus marginalus	Pedophrya steinii
" "	Opercularia articulata
Larva of culex pipiens	Epistylis umbelicata
Tipula larva	Epistylis pyriformis
Phryganidæ larva	Podophrya phryganidarum
" "	Epistylis brancheopyla
*Jules marginatus	Nyctotherus velox
*Dictoglossus pictus	Haptophrya gigantea
Succinea amphibia	Concophtheris
Fish	Trichodina scorpaena
" trout	Icthyophthirus
Porcellana platycheles (a crab)	Ophryodendron porcellanum
Caprella	Hemiophrya crustaceorum
Crustacea	Ophryodendron multicapitatum
Asellus aequaticus	Zoothamnium aselli
" "	Opercularia stenostoma
" "	Vorticella crassicaulis
" "	Carchesium aselli
" fluviatilis	Zoothamnium macrostylum
Astacus fluviatilis (cray fish)	Cothurnia sieboldii

Astacus fluviatilis	Cothurnia astaci
" "	Dendrosoma astaci
" "	Podophrya astaci
Hydra	Kerona polyporum
"	Trichodina pediculus
Hydroids and polyzoa	Acineta livadiana
Hydrozoa	Ophryodendrum abietium
Sertularia	Podophrya lyngbii
"	Ephelota trold
..	Ophryodendrum abietinum
..	Hemiophrya microsoma
..	Ophryodendrum sertularia
Zoophytes	Acinetopsis rara
Clytia volubilis	Acineta crenata
" "	Ophryodendrum belgicum
Plumularia setacea	Hemiophrya pusilla
"	Ophryodendron abietinum
"	Pedicellatum
*White ants	Trichonympha
"	Pyrosonema
..	Dynenympha
*Sheep and cattle	Isotricha
" "	Ophryscolex purkinjei
*Swine	Balantidium coli
Soenuria variegata	Ptychostomum
" "	Hoplitophrya pungens
*Pelobatus fuscus	Opalina intestinalis
*Phyllodoce	Anoplophrya ovata
*Cockroach	Nyctotheris ovalis

A Camera Lucida for Use with both Eyes.

By ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

When using the camera lucidas, which are on the market, of course preference is given to that known as Abbe's and invented by Wollaston. Abbe's is not altogether satisfactory and Nachet's is better. But I have an instrument which can be used with both eyes at the same time which seems to be a novelty. And this one besides useing both eyes was home-made so that its manufacture is extremely cheap. Besides, it has the novelty of being made by myself, and can readily be so made by anyone.

A brass cap is made to fit loosely over the eye-piece of the microscope so that it can be moved around and the camera pointed to any point of the compass. This is important as will be shown further on. Upon this is placed a prism of 30°. This can be obtained at any ordinary opticians. The prism is of ordinary crown glass and is rather large as purchased but out of it two or four prisms can be cut. I find it can be cut with a red hot poker placed upon it along the line which it is desired to cut. The cut surfaces can then be ground down with an ordinary hone with emery and water. This takes some time but is not essential. The microscope is placed in a slanting position which is advantageous, for the camera lucida can be placed upon the instrument without having to turn it over until it points transversely.

The object is viewed in the ordinary manner. Now when viewed through the camera lucida, the object seems to be moved towards the smallest side of the prism. That is to say the ray does not go through the instrument in a straight line but is bent toward the thin edge of the prism and in this way it seems to move the object out of the microscope to one side. When the left eye is used on the microscope the thick side of the prism is on the same side, i. e. the left. The object seems to be moved towards the right. It is there thrown down on a paper which is used to delineate it by means of a pencil. This pencil is seen by the right eye and in consequence of the two eyes being in use the object seen by left eye is transparent to the paper and seems to be where the pencil is. Of course such a camera lucida is not perfect. But it comes into play very often. And this was the shape I made it into.

I propose to use a plano-convex lens with the convex side uppermost where the right eye is placed and this will make it more certain. For if the lens is twelve or fifteen inches focus it can be used to see the pencil point

and also to fix the eye which has a liability to wander. I
find in my case I can move one eye without the other,
and this makes the image which is formed by the right eye
move. Of course when the left eye is used to see the pen-
cil point the prism can be reversed and sometimes it is
useful to move it around from the east to the southeast.
But these movements can be variable, as can be seen. I
wish this camera could be tried, for it is easy to make and
easy to use.

Brackish along with Fresh-water Bacillariaceæ.

BY ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

I have to record again living brackish Bacillariaceæ
along with fresh water ones. And it occurred only a
few days ago. One Sunday, in the latter part of June
with a bottle in hand, for I never go without one, I was
watching the turn of the tide at Bellville, N. J., near the
bridge. I saw the water which was coming from a cut
off where the Myriophylum and Anacharis was plenty,
and snails, Lymnea and Plunorbis in profusion had on
the top a dust of Bacillariaceæ and other things. I saw
it go down the river, which is brackish here until it
passed to Newark bay and so to the ocean. I wondered
what became of those fresh-water forms when they came
to the salt water. Did they all dissolve or did they
transform into salt-water forms ? I got a bottle full of
the water and brought it home and examined it and have
it now growing in my window. There was a plenty of
Nitzchia obtusa, var. brevissima, A. G., Cyclotella striata,
Eunotia monodon, Gomphonema turrio, Navicula cuspi-
data, Synedra ulna, and various other fresh-water forms
but there was living Coscinodiscus excentricus and
Surirella striatula. Both of these are put down as brack-
ish forms, but I had them here in fresh-water along with

a Closterium, a desmid, and more wonderful still a Dictyodia fibula, with endochrome in it. This is removed from the Diatoms and placed among the Rhizopoda.

Now what can become of these when they pass down to the sea ? They may be dissolved, for they are readily soluble in fresh water and presumably in salt-water although they may not be as soluble. Or they may change. The Surirella striatula and Coscinodiscus excentricus may live as salt-water forms, for they have been seen so and the others die. The spot where I collected them was where the fresh-water flowed into the brackish, and Newark, which is only three miles further south, and where salt water is very brackish, and New York bay, which is nine miles further off is salt. So that we have a quick change from fresh to salt water and they can be watched.

EDITORIAL.

Small Attendance at the A. M. S.—We have just read in an exchange the query which the writer seems unable or unwilling to answer : "Why is it that the membership of the society and attendance at its meetings are so small?" The reasons are quite apparent but one hates to state them. The truth, if it must be told, is that a little group of officers and candidates for office run the meetings for certain very narrow, or for personal ends. There is never exhibited a broad spirit of philanthropy, never a sufficiently deliberate purpose to interest new recruits in microscopy, never sufficient means to enable then to learn the business, never reports from local societies, never steps to found additional local societies, never grants of money for philanthropic investigation with the instrument, never practical application of microscopy to hygiene, to health, to happiness of the masses.

A few specialists, a few college professors, a few doctors, get together to do what is of personal interest to themselves, to read accounts of what they have occupied themselves

about in the past, discuss such topics as vivisection, and the supposed right of all scientists to practice it without restriction or inspection. How can others feel much interest in such doings?

The conduct of the society as now run seems to be tinctured with selfinterest, and the devotion of one's time and thought to self leads to the alienation of others.

That bee-in-the-bonnet—to become F. R. M. S. and to be able to label one's name with those letters seems to overshaddow the minds of the little group who go to the meetings, so that they are blind to what would interest a large number of people. This, if true, will sufficiently explain why so few join the company.

The greatly decreased number of local societies and the loss of interest in their work throughout the country has never given the American Society any concern. Never has it lent any aid to small and struggling societies, never has it asked after their welfare, never has it invited them to send delegates to its meetings. It does not even present them with copies of its Transactions. It leaves them all to get on as they may, and that has been for many years past towards decay.

Another thing the Society might have done and it never has done so. It might each year bring one of the world's great microscopists from Europe to deliver an address, and to advise regarding its work. The announcement in the periodicals, three months in advance, that Nelson or Dallinger, or Abbe will be present would mean that men will make efforts to attend who will not go to a mutual admiration circle. The money spent in publishing papers that were never read and absolutely verbatim reports of business discussions would suffice to bring one great guest to the meeting annually. All such papers could be published without cost to the society and the money now wasted be made useful.

In the last volume, one hundred and twenty-eight pages were occupied with eleven papers which were not read at the meeting, their authors were not present and very likely the papers were not completely written till after the meet-

ing. The thirteen papers which were read occupy one hundred and thirty-five pages. Why should people go hundreds of miles to the meeting to hear—

13 papers which will occupy 135 pages and to miss—

11 papers which will occupy 128 pages when every word uttered at the meeting will be sent out in type?

Notice this sample of wasted space :

"Secretary.—This completes the list, Mr. President."

"President.—We are now under the head of ordinary business."

"Secretary.—I wish to say that all members who have read papers and have not handed them in are requested to do so as soon as possible as I wish to have the Transactions out about the first of December, if possible, and surely before the holidays [Applause]."

The Proceedings were out the following June with "March, 1897" printed on the cover. By waiting, one may read every word and need not go to the meeting to hear anything.

There is probably not another society in the world that prints all this minutiæ. It is a waste of money. The most successful societies now relegate all the business to secret meetings of an executive board. Who cares to go from New York to Toledo to hear the full society discuss the advisability of printing 400 copies of the constitution ? The excuse for this printing is that not one in twenty of the members are present and that they must be informed of what goes on. Many of them pay their dues and if they do not get what is in the book, they get nothing therefor. But this in turn becomes a cause of small meetings.

Men do not like to confess their ambitions. If they did, we should probably hear from nearly all those who contribute to the Proceedings that they are candidates for the un-American English honor of F. R. M. S. The English society judges candidates by their technical publications and judges Americans by this volume in question. This fact is known by the members of this little group. Do not they act with this fact in view ? And do they not largely forget and ignore matters of general interest or

utility in their desire to be successful candidates for F. R.
M. S. If so, how can it be expected that the meetings will
be large?

Each year the president of the society receives the long
coveted honor. The records will show, that having got-
ten it, he usually graduates from all active connection with
the Society. Annually relegate one of the most active
members to obscurity and what should be the effect in the
19 years the society has been in existence? Do we need
go further in order to answer why the attendance at the
meetings is confined to a small group of people? If a man
can get his paper before the Royal Microscopical Society
by delivering it to the secretary of the American Society
in time to go into the Proceedings why should he be to the
time and expense of a trip to Toledo?

What then is necessary for the success of the Society?

1.   Change its whole spirit and methods.

2.   Elect only such men to the presidency as have
largely advanced microscopical interest in America.

3.   Pay the expenses of a distinguished microscopist to
visit each meeting.

4.   Transfer all business to secret sessions of a Board.

5.   Publish only the results of business discussions.

6.   Publish no paper that has not been read at a meeting.

7.   Publish in full only such papers as are of great
value and require expensive illustrations.

8.   Publish brief abstracts of minor papers, leaving the
periodicals to publish them in full.

9.   Leave to periodicals all that properly belongs to
journalism.

10.   Permit and encourage the periodicals to publish all
that they can of the papers read and of the president's
address.

11.   Be at work all the year preparing something that
will interest a large number of people.

12.   Take great interest in the welfare of the local
societies and invent means to help them to prosper.

13.   Receive their delegates as honorary members, enter-
tain them and send them home full of enthusiasm.

14.   Let alone and repudiate this un-American title F. R. M. S. and make F. A. M. S. an equal or superior honor, but let it be conferred only for philanthropic work done.

15.   Meet only at central points within easy access of many members.

16.   To double the membership, halve the cost of membership.

17.   Treat the periodicals so fairly and liberally that they will work for the society all the time.

18.   Banish narrowness, selfishness, cliques, cranks, unworthy ambitions and decide to become a power through the actual benefit conferred on the public.

19.   For extremely technical papers which almost no one can understand substitute largely papers that educated people can see some meaning in.

20.   Show continually the usefulness and application of the microscope to all branches of practical industry and the advancement of human happiness.

MICROSCOPICAL MANIPULATION.

Staining the Tubercle Bacillus in Sections.—This can easily be done by the methods recommended originally by Ehrlich and by Ziehl.   Many slight modifications in technical details have been introduced by a large numbers of workers, but the essential step by which the Bacillus tuberculosis can be differentiated from other bacilli consists in the use of mineral acids, such as nitric or sulphuric acid. When bacilli have been well stained with methyl-violet or with fuchsin, it is found that certain dilutions of sulphuric acid and nitric acid will rapidly remove the stain from all known pathogenic bacilli, with the exception of the bacilli of tuberculosis and of leprosy, which are discolored very much more slowly.   The use of nitric acid is, however, objectionable when one has to deal with delicate tissues, and even sulphuric acid, diluted with six parts of water, will cause a certain amount of distortion.   For this reason bacteriologists have long wished to find a method in which the use of strong acids was done away with.   Dr. Borrel,

after using a method in some researches in tuberculous lesion, has strongly recommended the following :

After the sections have been stained in the usual way by means of carbolised fuchsin, they are placed for a short time in a solution of hydrochlorate of aniline, and after this they are left in alcohol till quite decolorized, when it is found that though the fuchsin has been removed from all the tissues, the tubercle bacilli remain deeply stained.

This method, therefore, resembles very closely the Gram's method, with the difference that, instead of Gram's iodine solution being used to fix the stain in the bacilli, in this case it is Kuhne's hydrochlorate of aniline which is used.

Dr. Ratcliff, being engaged in delicate experiments on the spread of tuberculosis in the laboratory, was advised to try this method, which seemed to present many advantages over the older methods, when a few bacilli only are present in the organ. The details published not being quite sufficient to obtain very satisfactory results in every case, we worked out the details now given with the result that we can strongly recommend the following procedure :

(1)   Fix tissues by means of perchloride of mercury, acidulated or not, and then hardened in alcohol as usual.

(2)   Embed tissues in paraffin, using toluol as a solvent.

(3)   Fix section on slides by means of glycerine albumen in the usual way.

So far, there is nothing new in the method.

(4)   Stain with hæmatin solution for ten to twenty seconds to obtain a pure nuclear stain (not too deep) ; then wash thoroughly in water.

(5)   Stain now with Ziehl's carbonized fuchsin, kept at a temperature of about 47 degrees C. for twenty to thirty minutes. The slides are during that time kept in a moist chamber to prevent the stain drying on the specimen.

(6)   Remove the stain and treat the section with 2 per cent watery solution of hydrochlorate or aniline for a few seconds.

(7)   Decolorize in 75 per cent alcohol till the section is

apparently free from stain; this will take from fifteen to thirty minutes.

(8) Double stain with a solution of orange (1 per cent of saturated watery solution of orange to 20 to 40 parts of 50 per cent alcohol).

(9) Dehydrate with absolute alcohol.

(10) Clear very rapidly with xylol.

(11) Mount in xylol and Canada balsam.

A New Method of Staining Nervous Tissue. Vasta-rina-Cersi (Rif. Med., Feb. 14, 1896.) describes a new and effectual method of staining the spinal cord, etc., for macroscopic purposes. The entire cerebro-spinal axis, with the meninges, is plunged into about 3 litres of an aqueous solution of formaldehyde (16 per 1000). The tissue is left in the medium for two weeks, the meninges being removed on the second or third day. Sections from 3 to 5 cm. thick are then cut and kept in distilled water, or, better in alcohol at 40 degrees, for twelve or twenty-four hours; then plunged into 75 degrees solution of $AqNO_3$ in the dark. The white substance soon becomes stained brown. A prolonged stay in the $AqNO_3$ sol. does no harm. The stain may be fixed for an indefinite time if the preparation s left for two or three days in the dark in distilled water and then in alcohol at 70 degrees. Tissue so prepared shows in the clearest manner the relations between the white and the grey substance. For example, in the medulla one could distinctly see with the naked eye the respiratory fascicules of Krause. The advantages claimed by the author for this method are its simplicity and rapidity of execution, the constancy of the results, and its great teaching value.—Brit. Med. Journ.

BACTERIOLOGY.

Potato Agar.—Dr. H. M. Richards, of Barnard College, has proven the potato agar to be of great service. It is prepared as follows : Three or four medium-sized potatoes are washed, pared, cut into pieces and boiled in one liter

washed and again boiled one-half hour; the liquid is then filtered through cotton, then through paper, and serves as the watery basis of the agar. One per cent of peptone, ½ per cent of salt and 1¼ per cent of agar are added to one liter of potato water and the whole boiled over a flame for about three quarters of an hour. The medium is then titrated to determine its reaction, and brought to react 0.15 acid phenolphthalein. If alkali (Na O H) or acid (H Cl) is added, the boiling is continued one-half hour longer. The medium is filtered through absorbent cotton sterilized for three consecutive days at twenty-four hour intervals, and then put into test tubes and sterilized. After the last sterilization the medium is allowed to harden on the slant.

MEDICAL MICROSCOPY.

Diagnosis of Pregnancy.— Dr. Park of Philadelphia reports that pregnancy may be diagnosed as early as twenty days after its occurence by a study of the triple phosphates in the urine. The feathery appearance disappears from the tips of the crystals sometimes from one side only at first, followed by a like disappearance from the other side. If the fetus dies the normal appearance is renewed. This diagnosis of course affords the advantage that it can be made without suspicion on the part of the patient.—Am. Gyn. and Obst. Jour.

Examination of Blood in Diphtheria.—A microscopic examination of the blood will enable us to make a more intelligent diagnosis in diphtheria. If the myelocytes —i. e., mono-nuclear white blood corpuscles, with neutrophile granules (excluding both the mono-nuclear leuccytes poor in chromatin, considered by Frankel as characteristic of leukæmia, and also the large mono-nuclear eosinophile cells of Muller and Rieder)—are present in quantities of two per cent. or more in the blood of a diphtheria patient, the patient will die; but a smaller percentage does not of itself justify a favorable prognosis. The highest percentages found in diphtheria patients who re-

cover were 1.5 per cent., 1.4 per cent., and 1.3 per cent., and these were present only at the height of the illness, sinking back very shortly to 0.7 per cent., 0.1 per cent., and 0 per cent, respectively.

The maximum of myelocytes found in the blood of those who died of diphtheria was 16.4 per cent. On the other hand, eight cases died without any noticeable increase in the quantity of myelocytes. The author cannot yet state at what day of the illness a bad prognosis may be made, but in one case in which he was able to examine the blood on the fourth day he found 12.8 per cent. myelocytes. The first case died seven days later; the second, eighteen days after.

Interesting observations are recorded with regard to the numbers of other white cells, eosinophil cells, etc; but apparently no very definite conclusions can be formed with regard to them.

BIOLOGICAL NOTES.

Chalk.—A sheet of chalk more than 1,000 feet in thickness underlies all that portion of England which is situated to the southeast of a line crossing the island diagonally from the North Sea at Flamborough Head to the coast of the English Channel in Dorset. This massive sheet of chalk appears again in France and as far east as the Crimea and even in Central Asia beyond the sea of Aral. There can be little question that all these now isolated patches were once connected in a continuous sheet, which must, therefore, have occupied a superficial area about 3,000 miles long, by nearly 1,000 broad. These enormous deposits are made up of the microscopic remains of minute sea animals.

Hair on the Pulvill lof Flies.— With regard to the difficulty respecting the hairs on the pulvilli of flies, is it to be expected that the hairs should be hollow, and in the nature of ducts for the viscid fluid secreted by the glands ? Do they—the hairs—not act rather as a simple mechnaical

method for enabling the insect instantaneously to detach its foothold from the object upon which it has been resting and supposing the pulvillus to be hairless, and the secreting surface to be brought into close connection with the object, would there not be great difficulty in the creature at once liberating itself?

Action of Light on Fungi.— M. A. Lendner records (Ann. des Sci. Nat. Botan.)the result of a series of experiments on the effect of the access and withdrawal of light on a variety of fungi, chiefly mucorini and ascomycetes, grown on different media. All the mucorini examined developed sporanges under the influence of light when grown on solid substrata ; in liquid media the results varied with the species. In the case of the conidial forms of the ascomycetes, conids were invariably formed under the influence of alternate day and night; under continuous light the results varied with the species. All the phenomena of heliotropic sensitiveness in fungi appear to have their source in the need for nutrition.

NEW PUBLICATIONS.

The Canadian Entomologist is a bright and newsy dollar magazine from which we extract items occasionally. The contributors are nearly all United States people, a recent number containing eight articles all from the states and none from Canada. The April number had seven U. S. contributions to three Dominion. How can Canada with only a few entomologists maintain such a magazine ? We suspect because cheap living makes cheap cost of printing while money and articles come from us to support the same.

Recent Articles.—F. Chapman writes in the May Geological Magazine on the Microscopic Contents of a sample of Bracklesham Clay from the Solent.

Prof. R. Jones describes in the same number some new Entomostraca from Brazil.

Sisymbrium altissimum.
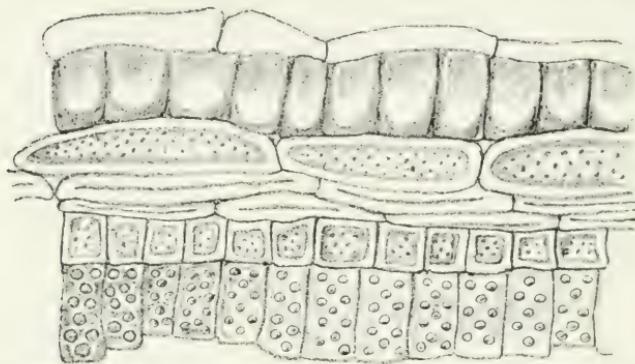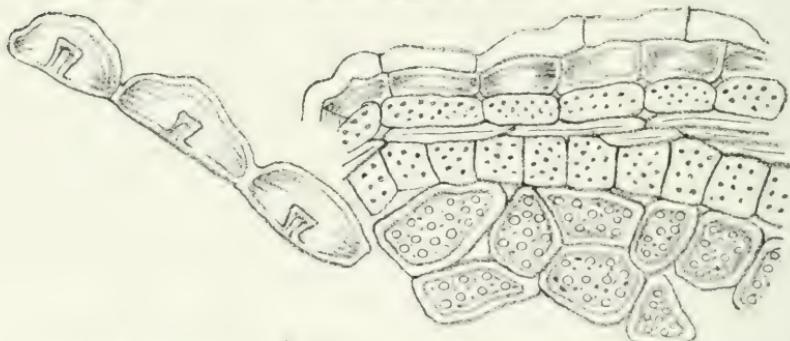
Capsella bursa-pastoris
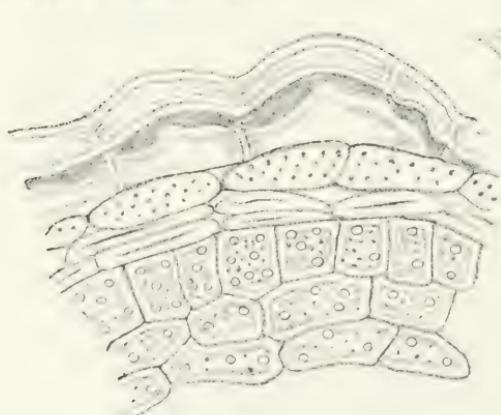
Sisymbrium officinale.

SEEDS AND TESTA.

On the Seeds and Testa of Some Cruciferæ.

By L. H. PAMMEL,

AMES, IOWA.

[Contributions, No. 6, Botanical Department, Iowa Agricultural College.]

WITH FRONTISPIECE.

SISYMBRIUM OFFICINALE, SCOP.

Pod a half inch long or more, awl-shaped, somewhat four sided, borne on short erect pedicels, twelve seeded, seeds light brown, oblong, or in some cases, triangular, one half to three fourths of a line long. Caulicle extending lengthwise with a depression between it and the cotyledons. Cotyledons incumbent.

Seed coats quite uniformly developed. Cuticle covering the epidermal cells, the latter tabular, much compressed. On the addition of water the cell walls become mucilaginous with evident stratification. The second layer of cells brown and thin walled, much compressed. On addition of chloral hydrate they expand. Third layer much darker than the second, thick walled, followed by endosperm, cells elongated filled with protein grains, followed by elongated thick walled cells with a small cavity. These reach their highest development between cotyledons and caulicle. First row of cells of the embryo nearly isodiametric, filled with protein grains and oil.

S. ALTISSIMUM, L.

Slender, slightly curved pods, two to four inches long, firm. cylindrical. Seeds light straw colored, one-half to three-fourths line or less long ; oblong or nearly triangular.

On the addition of water the cell-wall of outer seed coat becomes mucilaginous. Outer epidermal layer covered with cuticle, cells elongated, on the addition of water, walls become mucilaginous and show stratification. Cell-walls of second layer thick, light brown, followed by endosperm of two layers of cells, first elongated, thick-walled.

Cells of embryo as in S. officinale.

LEPIDIUM VIRGINICUM, L.

Pod orbicular or oval, a line and a half to one and three fourths lines long, larger than L. apetalum, with a small notch at the top, slightly margined above, often purple tinged at maturity. Seeds pendulous, light brown, minutely pitted, with a narrow winged margin, one line long. The caulicle runs lengthwise, on each side a groove, marking the boundary between the caulicle and cotyledons, the latter accumbent. On the addition of water the outer-walls become mucilaginous.

The seed coats consist of three well defined layers. The outer or epidermal cells are tabulated, somewhat compressed. The cuticle forms a continuous layer over these. On the addition of water the epidermal cells elongate and form a mucilaginous mass, showing stratified layers. These are not difficult to make out when the specimen is mounted in water. The cell cavity is very much reduced, that portion of the cell-wall in contact with the cell-cavity is differentiated from the outer cell-wall substance. Long continued addition of water causes the cuticle to break and the exterior becomes very irregular.

The second layer is colored brown, the cell-walls are considerably thickened laterally and project upwardly in the shape of cones. A section made through the ends of these seeds shows that the second layer is considerably more developed and there are evidences here of an indistinct layer between the first and second. The layer following this consists of thin walled parenchyma cells, in some cases considerably elongated but in others short.

The third layer is followed by the endosperm which consists of a layer of rather thick-walled parenchyma cells. These carry granular protein grains. This is followed by one or more layers of elongated cells, in which the cell cavity is very much reduced. These cells reach their highest development between the folds of the caulicle and cotyledon.

The Embryo :—The first layer of cells of the embryo are smaller, quite uniform in size and filled with protein grains and oil.

LEPIDIUM APETALUM, WILLD.

Pod a line and a quarter to a line and a half long smaller than Large Pepper grass, slightly notched at the apex, minutely pubescent.

Seeds pendulous, light brown, very slightly roughened and very narrow wing margined. Smaller than in L. virginicum, three quarters to nearly a line long. Caulicle extends lengthwise, with a prominent ridge as in L. virginicum, with a sharp groove between caulicle and cotyledons, the latter incumbent and flattened, a character which easily separates the species from the Large Pepper Grass.

The cuticle forms a continuous layer over the epidermal cells, the latter are larger than in L. virginicum. On the addition of water the cell wall rapidly elongates, emitting a copious mucilage, the cell-cavity is very much reduced but longer than in L. virginicum. It is sur-
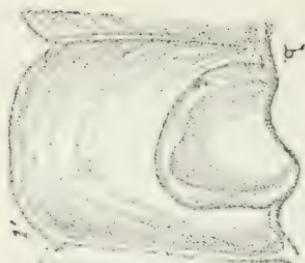
Lepidium Virginicum
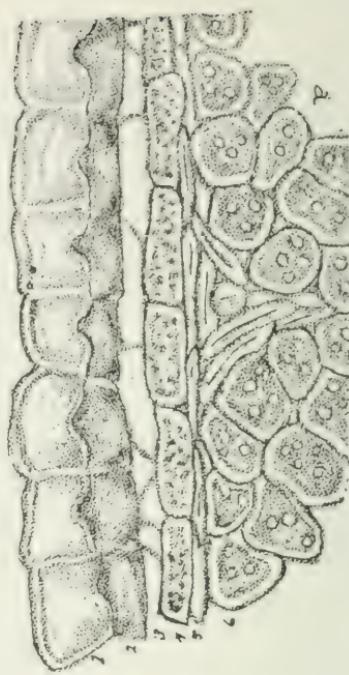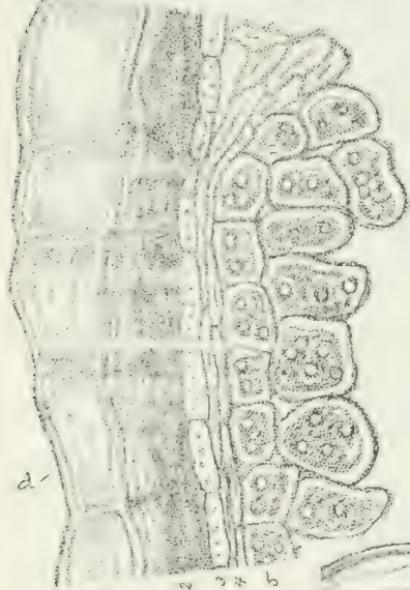
Barbarea vulgaris

Lepidium apetalum
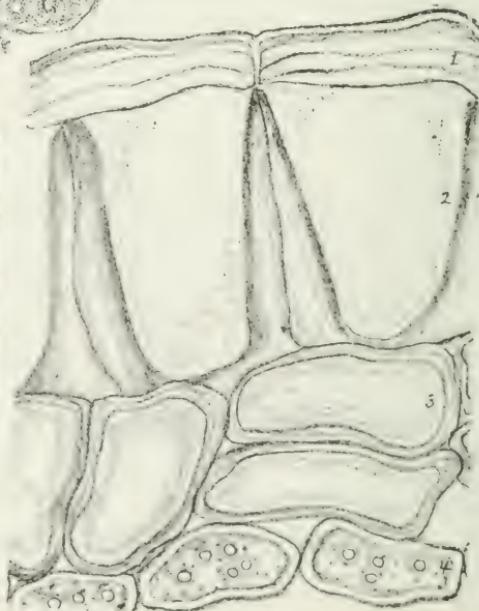
rounded by a denser, more or less differentiated, part of the cell wall which is more yellow in color than the remainder of the cell-wall. The second layer is of a yellow straw color and consists of very minute cells with small cell cavities.

The cell walls of the third layer are strongly thickened brown and serve the same purpose as in the other species. The endosperm consists of thick walled parenchyma cells. In the first layer of cells the cell-walls are very much larger and packed with protein grains. The other layers of endosperm consist of small elongated thick walled cells with a small cell-cavity. These attain their greatest development between the caulicle and cotyledon. In the embryo, the cells of the first row are isodiametric filled with protein grains and oil. The outer cells are elongated, larger, and also densely packed with the same material.

Capsella bursa–pastoris, Moench.

Pods two to three lines long, two to two and a half lines wide above, some of the European specimens with larger pods, many seeded (8-22), seeds light brown, one half line long, nearly one fourth line in width, very minutely roughened. Caulicle elongated forming a ridge with slight depressions between it and the cotyledons. The latter incumbent. On the addition of water the outer seed coat becomes mucilaginous.

Microscopic Structure.—The seed coats attain their maximum development in the region of the caulicle. Cuticle covers the epidermal cells, the latter tabular, compressed but on the addition of water they elongate, become mucilaginous and show stratification.

The second and third layers are brown with thick cell-walls. Fourth layer consists of endosperm, one layer of isodiametric cells filled with protein grains, followed by thick walled cells reaching their greatest development

between the cotyledon and caulicle. First row of cells of embryo nearly isodiametric, filled with oil and protein grains. Others somewhat larger and contain the same substances. Cotyledons incumbent. Central part of of caulicle separated from the rest. Cells of caulicle very much larger than cells of cotyledons.

Barbarea vulgaris, R. Br.

Pods erect or slightly spreading, one half to three quarters of an inch long, somewhat quadrangular. Seeds blackish, a line or little more long, a single row in each cell, marginless. Cotyledons incumbent.

First layer of outer seed coat not well developed, cells elongated in the direction of the seed. Cuticle covers the epidermal cells. On addition of water a slight mucilaginous modification takes place. Second layer with thick lateral walls and quite large cell-cavities, colored brown. Third layer of rather thick-walled paren-chyma cells also colored brown, followed by endosperm, as is usual in cruciferous seeds.

(To be continued.)

The Diagnosis of Malaria.

By ARTHUR R. EDWARDS, M. D.,

CHICAGO, ILL.

The diagnosis of malaria, like its pathogenesis, has a scientific life of scarcely two decades. The subject has been roughly handled since an acquaintance with its microscopic diagnostic methods has reached the general profession from the laboratories of scientific biologists and clinicians. Positive blood findings, i. e., the detec-tion of the plasmodium of malaria, establishes the fact of malaria, since malaria is always caused by the parasite, and again the organism is always found in malaria and in malaria only. A few microscopic examinations will

convince the greatest skeptic. It must not be forgotten that, in certain instances, two diseases may occur simultaneously. We have seen malaria in conjunction with various ancient heart lesions, ulcerative endocarditis, pulmonary tuberculosis, chronic nephritis, although never with typhoid fever. The presence of malaria plasmodium makes possible positive differentiation from other diseases ; e. g., the frequent error of overlooking or misinterpreting an incipient pulmonary tuberculosis attended with chills. Negative blood findings, in suspected malaria, are not definitive from one examination. Not infrequently is more than one microscopic search necessary for the positive exclusion of malaria. While suggestive, then, a single negative finding is far from conclusive. The parasites may be indistinguishable in the first few days of the disease. In certain forms they swarm in internal organs, avoiding the peripheral circulation ; and lastly, in chronic and recurrent types they are found with great difficulty.

Certain deformities in the red blood corpuscles are often mistaken for plasmodia, e. g. crenations, poilkilocytosis and vacuole formation. Not only can the more intimate structure of the red blood discs retract, simulating plasmodia, but the exterior of the hemacyte is far more plastic than is commonly acknowledged, even to the extent of protruding pronounced pseudopodia-like processes. These are but too frequently mistaken for parasites, being found in very many instances of apparently otherwise normal blood. Vacuole formations are characterized by their sharp contour and high luster.

Melainferous leucocytes are readily distinguishable from the plasmodia by their large nuclei and by their amoeboid movement, always absent in adult parasites of equal size. Unstained spores may be confused with the blood plaques, which are, however, structureless and contain no pigment. An Austrian pediatrist lost a docent-

ship for reporting, as malaria, cases whose blood prepara-
tions afterward proved to contain only blood plates and
no plasmodia. Coagulation products have been confused
with flagella. Many of the small dots seen in malaria
which resemble micrococci and were mistaken for such
by the earlier Italian observers are similar to those
found in most anemias and described by Ehrlich as
degenerative changes.

TECHNIQUE.—Complex methods of staining and count-
erstaining the parasite have been in vogue, but the sim-
plest and most accurate is the direct examination of the
freshly-drawn unstained blood, a method we have used
with entire satisfaction for several years. In this pro-
cedure injury to the corpuscles and staining of the blood
plaques are obviated.

The lobe of the ear is cleansed, picked, and a quite small
drop is gently expressed. A clean cover glass is held in
a pair of forceps to avoid the heat and moisture of the
hand, and is carefully brought in contact with the top of
the drop. The heat and moisture of the hand or rudely
placing the cover against the drop favor imperfect spread-
ing from precipitate drying of parts of the blood. Rub-
bing the slide well facilitates equable spreading of the
blood. Examination is best made with an oil one-twelfth
inch immersion lens, although Laveran used lenses of
lower magnification. Permanent preparations are pro-
cured by allowing the covers to dry, to remain half hour
in equal parts of absolute alcohol and ether and by paint-
ing with filtered eosin and methylene blue. The use of
stains is not usually advisable, since they obscure the
otherwise more brilliant microscopical findings, they act
as protoplasmic poisons, abolishing both the amoeboid
movement of the parasite and the highly characteristic
vibrations of its pigment, and finally, they stain the
blood plates and coagulation produces, thereby confu-
sing the findings, particularly for the unwary clinician.

THE TYPE.—Blood examination, however, demonstrates not merely the fact of malaria but also its types, since the various clinical forms of the disease correspond to 300 logically distinct, immutable species of parasite. Determination of species embraces more than purely biological interest; it declares also the prognosis, as in the pernicious forms, and designates the treatment, as arsenic in the tropical types. Councilman stated several years ago that in intermittent fever the parasite was seen within the red blood corpuscle, while in remittent fever or in malarial cachexia it was frequently seen without the same or in elongated forms and crescents. Crescents augur relapse. The presence of segmentation forms predict an imminent or incipient paroxysm. The alleged detection of the plasmodium is often doubted by us, since it is not uncommon to hear practitioners state that they have found Laveran's organisms, an error at least in species determination.

In general terms, the number of parasites found in the blood corresponds to the severity of the attack, although some believe the large spore-producing bodies remain largely in internal bodies.

MOTILITY.—In the ordinary tertian parasite there is lively amoeboid movement in the young and middle-aged forms. In the quartan form there is slight movement in the young parasite. In the aestivo-autumnal type it is variable, often very active.

PIGMENT.—In tertian malaria the pigment is pale and yellowish brown, is fine, and in the young forms is most active, or "swarming"; it accumulates towards the periphery of the parasite, in the pseudopodia protrudes, but in the older forms it becomes central. The pigment is inversely proportional in amount to the amoeboid movement, i. e., the more pigment the less the amoeboid movement.

In the quartan the pigment is coarse, being somewhat

larger than in the tertian, irregular, with but little if
any movement. In the aestivo-autumnal form the pig-
ment is active, although some describe it as slight, at first
fine, later course, even rodlike.

SIZE.—The tertian is as large as the red blood disc,
even larger; the quartan not larger than the red corpus-
cle, while the tropical forms are much smaller, from 1-5
to ⅔ the size of the hemacyte.

PROTOPLASM OF THE PARASITE.—In the tertian it is
pale and indistinct; in the quartan, sharply outlined, and
of a characteristically high index of refraction; in the
autumnal type it is ringlike, very small, hyaline, and
difficult to detect.

ALTERATION IN THE RED BLOOD CELLS.—In the ter-
tian the red blood cells hypertrophy, and are rapidly
and completely decolorized. In the quartan they are
but little decolorized, may be darker than normal, and are
not essentially altered in size, although the corpuscle
may become slightly smaller than normal. In the more
pernicious types they are shrunken, become either darker,
of "brassy" color, or completely decolorized, "shadow-
like."

SPORULATION FORM.—In the tertian the spores are more
or less irregularly grouped, individually small, round,
whose nucleolus is seldom seen in unstained specimens,
numbering 15 to 20 or somewhat less. The segmenting
forms are about the size of a red disc, and are of irregu-
lar form. The segmenting bodies are found in the peri-
pheral blood rarely, or in small numbers only, except at
the time of a paroxysm. In quartan malaria the spores
exist in the margarite form, spores being individually
long, with distinct nucleolus, 6–12 in number. The seg-
menting forms are smaller than a red blood corpuscle, of
a rosette form, are found in equal numbers in the peri-
pheral and visceral circulations, and may be detected in
the apyretic interval as well as in the paroxysms. In the

aestivo-autumnal types the spores are irregularly formed or stellate, six to eight in number, possibly more, and segmentation occurs chiefly in internal organs.

CRESCENTS AND FLAGELLA.—The crescents are found only in the aestivo-autumnal forms, and represent a very resistant form of the organism. They may exist for months at a time without fever or other symptoms. They may be converted into round bodies, from which flagellation is frequently observed. We have not seen crescents apart from extreme anemia. Persisting as they do we can scarcely consider them solely as degenerate forms ; they impress us rather as resting stages. Flagella may be found in any type, though not frequently in .quartan fevers. They may be seen when quinine has been previously given, and have been considered by some as degenerate forms. They are but rarely seen in freshly shed blood, but we have seldom missed them when examining a specimen for a long period, e. g. in clinic demonstrations.

INDIVIDUAL SYMPTOMS.—The diagnosis of individual or isolated cases is most intimately linked with the diagnosis by blood examination. Certain malarial symptoms are not only immediate sequences of the malarial infection but are also most beautifully explained by the life cycle, life activity and metabolism of the organism.

The melanemia corresponds with the structural disintegration of the hemoglobin of the red blood cells and its diffusion through the blood plasma. The anemia is secondary to reduction of the hemoglobin and diminution of the number of red blood corpuscles; in other words, to morphological hemodyscrasia. No leucocytosis is seen, save a transient apparent increase at the beginning of the paroxysm. The hemoglobin and red discs are destroyed in equal degree. The anemia is rapidly produced; in fact, corpuscular deglobulization is more rapid than in

any other acute affection, and can be utilized to differentiate from pneumonia or typhoid fever.

Each paroxysm being the ripening of a new generation of parasites, the fever corresponds to their sporulation and a saturation of the blood with toxines liberated from the red blood cells. It is a chemical hemodyscrasia, or, as Mannaberg aptly puts it, a "protozoan sepsis," analagous to that discharge into the blood steam of infective material observed in septico-pyemia.

We fully comprehend any clinical form of fever, when we realize that the fever is a toxic manifestation and that as often as the parasites segment, fever occurs. Hence two generations of tertian parasites cause quotidian fever, also caused by three generations of quartan parasites of unequal age. Quotidian continued fever accompanied by splenic tumor, the diazo-reaction, and even roseolæ or slow pulse, may cause difficulty in diagnosis from typhoid fever, especially as typhoid may be attended with chills and sweats. The blood examination speedily differentiates and Widal's serum test for typhoid is of great aid. The splentic tumor and bone pains are explained by the phagocytic process in their substance, the hemoglobinuria, diarrhea, retinae and other hemorahages by the toxemia, the cerebral symptoms, as coma, convulsions or bulbar symptoms, by aggregations of the parasite in the cerebral vessels with thrombosis.

Casts of Bacillaria from the London Clay.

BY ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

The London clay is lower Eocene resting on the Cretaceous and is below the Miocene Tertiary. The Eocene has not been examined in this and other countries for the diatoms in it but they are probably there.

Mr. W. S. Schrubsole sent me some specimens from the

London clay. It is from beneath the Red Crag which is called the older Pliocene. There is no Miocene, which belongs between these, and we expect to find the diatoms very different. The forms that exist in the Pliocene are about the same that grow now. The Pliocene diatoms of England have not been studied. Some Pliocene are enumerated in a paper on the Diatomaceous deposit of the mud of Milford Haven and other localities, by Fitzmaurice Okeden, in Vol. III, 1855. The celebrated Glenshira sand which is described in the same volume is most likely correlative with the Champlain clay, the Raised Coast Period of our shores, judging from the diatoms in it.

The London clay consists of a brown or bluish grey clay, containing layers of concretions called septaria,— "flattened nodules of calcareous clay, iron stone or other matter, internally divided into numerous angular compartments by articulating fissues which are usually filled with calcareous spar and show well against the darker matrix of the nodule." Now that we know something about the power of calcareous matter to replace siliceous in organisms, for which we are indebted to the researches of Sollas, Hinde, Zittel, Hill and Jukes-Browne, we can reason as to what septaria are or were. Most likely they were siliceous sponges. One author thinks that "the reticulating fissues or septa (hence septaria) seem to have arisen from shrinkage of the mass while in the act of consolidation, and to have been subsequently filled by infiltration. Such argilaceous, calcareous, and ferruginous nodules are common in many clays and marls, as in the shale of the coal formations, in the Oxford clay, in the London and Barton clays. They are often arranged in lines and bands; are always more or less flattened; generally contain some central organic nucleus round which the matter has aggregated, such as a leaf, scale, coprolite or the like ; and when split up in the direction of the

stratification, frequently exhibit very curiously marked
sections. Hence the names; beetle stones, turtle stones,
Ludi helmontii and the like. The fossil species of the
Island of Sheppy indicate a much more tropical climate
than the Eocene flora of France. The coast was sunk
lower then and was warmer. The larger fossils are more
tropical and the Bacillaria are more tropical. We find
specimens of Arachnoidiscus there. It is comparatively
a scarce form in that region. One specimen has been
seen in England and one in Ireland. It is common in
the Pacific states being brought to that coast by the Kura-
Sigra or Janauss current from Japan where it is com-
mon also.

Cleaning the London clay carefully and viewing it by
means of the microscope transparently, it is seen to con-
tain sparsely certain discs that are black; and looking
them over some will be seen semi-transparent and so
fashioned as to show that they are diatoms. They were
first Coscinodiscus asteromphalus,— little discs with
hexagonal markings all over them. The London clay
diatoms show the structure much more clearly than can
usually be seen in transparent specimens. The cell mem-
brane, which is colloid silica is removed and an internal
cast of the cells shown. When they are viewed by front
view they are seen to be curved outward on the interior
and exterior, which is to say they are almost spherical.
The specimen looks as if the disc consisted of a series of
spherical balls set along side of one another. The mater-
ial of which the black substance is composed is pyrite
iron pyrites or sulphide of iron, formed by iron sulphate
in the salt water in which the diatoms occurred acting on
the organic matter of the diatoms, the protoplasm, which
was decomposed, the oxygen being set free and the iron
and sulphur thrown down as sulphide of iron. The dia-
toms can be seen when viewed with reflected light to be
glistening, almost gold-colored, particles. A ring look-

ing like diatoms is seen which is most likely Melosira sulcata though the diatoms are in a stage that their specific nature cannot be made out clearly.   There is also the Coscinodiscus, a cast of a Triceratium but the species is in distinguishableas the cast is opaque, lignite or pyrite. There is also a silicious shell of Stephonopyxis turris. The Triceratium looks like a cast of T. undulatum and perhaps should be placed there.   Sometimes the change has taken place in the sileceous shells themselves.   In that case the casts look like diatoms.   Instead of being transparent they are made up of dark substance, lignite or pyrite, and the cavity with the lorica is not marked at all.

As Bacillaria are in the London clay and it is marine also we can carry the Bacillaria down to the lower Eocene in Geologic time.

Notes on Formalin.

BY GEO. S. LIGGETT, M. D.,

OSWEGO, KANS.

Every microscopist should have some formalin on his work-table, especially the physician who uses a microscope.   It will preserve specimens indefinitely and will harden a specimen so that an expert can make sections without any other preparation.   I believe it will prove to be the most excellent preservative we have ever had. There is much to learn about it however.

Over a year ago I had a case of acute Hematuria.   The urine seemed all blood.   I had an eight-ounce specimen. After examining it and in order to keep it from decay I added some formalin.   Next day I was surprised to find it coagulated.   It has remained in that condition ever since.   The bottle is nearly filled with a soft and dirty greyish coagula.   In the bottom there is about an inch of a very hard and dark coagula.   Examination of it now

shows in the soft coagula, red blood cells that look normal. I thrust a tube into the hard coagula and obtained a piece from which sections could be cut. It is a mass of blood cells. A few of them are normal in size and shape. The most of them are contracted and round and cupped. I have stained and mounted specimens that have been kept so long.

Not long ago when using some formalin that had been left in an open dish for several days, I noticed that there was a number of dead flies around. I wish some one who has had experience in using the vapor as a disinfectant by burning in these new lamps, would observe and report whether it will kill flies. To test the question further myself I put some formalin in a saucer-like dish, in which I had melted some paraffin and in which was quite a good deal of the paraffin remaining. I did not find many dead flies but I noticed another peculiarity of its action that may prove useful to some one who knows how to take advantage of it. I found the paraffin changed into a white friable powder. I heated some of it and found that it gave off fumes of formalin in great quantity. It will not melt like normal paraffin.

Bacteriological Researhees Regarding an Epidemic of Horses now Prevelent in Canada.

BY DR. BENOIT, AND DR. PARIFEAU.

Some researches are being carried on in the laboratories of the hospital of Notre Dame regarding the nature of a contageous epidemic which is now prevaling among horses. The legs of the sick horses are covered with fistules which give birth, to an infectious suppuration.

The grooms who have to dress the sores of the sick animals are nearly all attacked on the arm or on the hands with an ulcer of innoculation, followed by ganglious pains and hypertrophies in the small of the arms and in

the arm-pits. At the same time they show all the signs
of a light general infection,—headache, insomnia, fever,
chilliness and loss of appetite. It is stated that the horses
are cured in about twelve days and they have no discharge
from the nose neither any signs of pulmonary affection.

Yet this disease was credited for some time to farcin for
the examination of different specimens of pus from dif-
ferent horses, taken with precaution in sterilized pipettes
have shown, under the microscope, the bacillus short,
in little chains, in a clean space, characteristic of the
glanders. But cultures upon gelatine and boulion give
only "staphylocoques dores purs."   It is a question
then what this horse epidemic is.

The Physician and his Microscope.

BY A. A. YOUNG, M. D.,

NEWARK N. Y.

One of the most expensive and one of the most useless
pieces of office furniture that the ordinary physician pos-
seses is his microscope.   It usually occupies a most com-
manding and conspicuous place in the office and decora-
ted with "fuss and feathers;" valueless as an educator,
valuable for the macroscopical appearances of the micro-
scope, for it is capable of producing wonder and awe to
the office visitor and shekels to the pocket of the physician.

Nothing can be said against the microscope as an
instrument, for its value resides in its intelligent use,
and unless used intelligently it becomes worse than use-
less, distorting facts and fancies alike, from which the
observer can form no concept, can draw no conclusion
save an erroneous one.   The physician has to deal with
the organic world, with those material forms in which
resides that peculiar, unresolvable and unknowable agent
we call life, and without which matter becomes compara-
tively valueless.

The microscope in the department of medicine requires for its intelligent manipulation a familiarity with anatomy, pathology, bacteriology, and last, but not least, biology, which subject scarcely ever enters into a medical college curriculum. We, as physicians, must deal with material forms that are endowed with life, and of that relation which exists between the material form and life we must have some concept, though it be partial and inadequate, for on the relation of things material or immaterial is the development of human thought possible. The life force of the bacillus is doubtless as intricate as the life force of the human subject and may be similar if not identical with it ; for what is the body in which the ego resides more than an aggregation of amebæ specialized, and each ameba possibly having an independent life and having reproductive properties of its own. It is with the minute mass of matter, not the molecule, that the microscopist has to deal ; he sees its manner and method of growth and not the forces which produce the molecular arrangement of the ultimate particles.

It is not enough that the physician be able to observe and differentiate the various forms of the micrococcus, spirillum or bacillus : he must know as well the habitat, manner and method of growth of each variety. Without this knowledge the revelations of the microscope are no more intelligible than some Egyptian inscriptions. There is a philosophy of microscopy which is equally as valuable as the facts on which it is based, but a philosophy that can only be developed by accurate observation and classification of microscopical data. This work, it is evident must be performed by the skilled microscopist and not by the novice, in which class the busy practitioner is usually found. In microscopical analysis no element relative to accuracy can with safety be omitted. It matters not though the microscopical accessories be thoroughly cleansed and sterilized, for the results would

be equally untrustworthy if the material to be examined be placed in a receptacle, found perhaps in some old garret and half cleansed. Conclusions reached under such conditions must be erroneous. Do you ask who ever allows such procedures ? Go to the home of the amateur or pseudo-microscopist, observe his methods and technique and you will have the answer. It is surprising how much we see, how much we assume and how little we know. A young physician asks an older one for the use of his microscope to examine a specimen of urine, assuring its owner that he is familiar with the instrument, having had instruction in college; permission granted, and slide prepared, and the observer exclaims, "The most beautiful specimen of a cast I have ever seen;" the owner of the instrument says, "That looks like vegetable matter and not a cast." "No," said the other, "that is a urinary cast; I have seen many of them." A microscopical examination of the container and its contents revealed a corncob for a cork; what the cast was you may readily infer.

A physician of several years' standing and the possessor of a good microscope at an autopsy of his announced that the patient's death was due to a disease of the kidneys, that she had been passing blood, pus, all forms of casts and other bad material with the urine. The autopsy, however, revealed ulceration with pus formation, degeneration and rupture of the gall-bladder, produced by impacted gall-stones, while the kidneys were practically normal, showing no structural degeneration. From whence, then, came the blood, pus, casts and debris, which was alleged to have been seen ? These cases could have been none other than of mistaken identity ; something was inferred that did not exist.

The conclusion is therefore reached, justly or otherwise, that the eye and understanding must be educated independently along certain lines before the manipulation of

the microscope becomes satisfactory and trustworthy; objects must be seen and known relatively and in their entirety before being resolved into their component elements: the macroscopical appearance of an object must precede its microscopical appearance.

The physician must know in what menstruum and under what conditions the objects for which he is searching exists or are developed. Neither is it enough for him to know and recognise the various forms of bacilli; he must be able to classify them and know their manner and method of growth, what they produce by their growth and what influence they have upon humanity. This is the philosophy of microscopy as relates to medical science. The microscope therefore becomes to the physician valuable in the degree that he is able to classify and arrange its revelations so that they may be read as from an open book. This faculty means a familiarity with the instrument born of time,—time which the "country doctor" must give by piecemeal, if at all.

I am no pessimist, although I see in a degree the passing of the microscope so far as it relates to the individual work of the ordinary medical practioner. As already intimated, this passing is induced and sustained by unskilled and untrained eyes, which see much and individualize little.

The structure of microscopy, if it be enduring, must be built upon a comparatively errorless macroscopy. The rank and file still have to learn that the microscope only enables the investigator to continue his eyesight so as to observe the primary structure of an organised mass that would otherwise remain unknown and unknowable.

The first essential, then, for a physician microscopist is the proper use of his eyes, supplemented by a keen intellect; what he sees he must be able to describe accurately, thus differentiating the various forms and figures that appear in the visual field.

Neither is it enough for him to recognise an object in an isolated condition and know its form and construction : he must know as well what relation it sustains to other objects about it. This calls for the wise exercise of the comparative faculty, the second essential for the physician microscopist; indeed, these two elements may be called his eyes. With these faculties undeveloped, untrained, he may as well be a blind microscopist. What is true of normal vision is pre-eminently true of aided vision, which aid the microscope is, but it produces changes also in the relative conditions of objects, and of such changes the mind must take cognisance; it is an element too often overlooked. In short, the revelations of the microscope become the alphabet and the systematic arrangement of these revelations in the human mind forms its language, a language that requires study to comprehend; a language also that needs much further development and amplification. Physicians, as a rule, can be novices only in microscopical science, following where others lead; they stand at your feet, at the feet of the microscopists of the world, in the relation of pupil to teacher, asking for more light to illuminate the intricacies of human existence.

Give to them this light ; save for them the microscope with all of its powers and possibilities which are vast ; prevent it by your efforts from relapsing into a state of "innocuous desuetude."

Notes on Technique.

By PIERRE A. FISH, D. Sc.,

CORNELL UNIVERSITY, ITHACA, N. Y.

In many of the modern articles, the methods by which certain pathological structures are demonstrated, if mentioned at all, are frequently so meager in the description of important details as to be practically useless to many

workers, unless a certain amount of their time is devoted
to experimentation. A person, who has obtained fairly
successful results with his older methods, is loath to for-
sake them, especially if his first few attempts with the
new are failures. Each investigator may have certain
laboratory conveniences ; reagents of the best quality and
dyes that have been well tested, all of which will enable
him to obtain results much superior to his less fortunate
colleague. It is difficult, therefore, to work successfully
unless details are carefully attended to, and the reasons
for the various steps understood. The methods following
have been well tested, and have been attended with uni-
formly good results, which in some cases, it is believed,
would have ended in failure with the older methods.

FIXATION.

The fixation of pathological tissues, with strong alcohol
for histological study, is very commonly employed for
the double purpose of killing at once any microorganism
that may be present and at the same time to preserve
the structure of the part. With many tissues this
caused a too rapid withdrawal of the contained water or
lymph, so that the specimen becomes hard and gives
unsatisfactory results when it comes to the cutting pro-
cess.

Some experiments with different reagents, upon known
pathological material, were of service in formulating a
mixture, which obviated the defects of strong alcohol
when used alone. This mixture, while quickly killing
the bacteria, also preserves most faithfully the histologi-
cal structure. Various solutions of formalin, including
the undiluted, were employed, and gave good results,
particularly the presentation of the bacteria, after the
usual staining methods. The tissues were more or less
swollen by the weaker solutions, in marked contrast to
the contraction caused by alcohol. Various combinations

of formalin with alcohol were also tried, and that which seemed to be most completely satisfactory for quick penetration and convenience, bacteriologically and histologically, was as follows:

95 per cent alcohol......... .... 100 parts.
Commercial formalin (40 per cent formic aldehyde). 10 parts.

Pieces of tissue, ½ centimeter square, are well fixed in from twelve to twenty-four hours, after which it is well to leave for a few hours in 95 per cent alcohol before clarifying for the paraffin bath. Specimens, transferred directly from the fixing mixture, have been clarified in chloroform or cedar oil, but it requires a longer time.

The addition of the formalin is advantageous, because in a way it brings about a state of equilibrium. The alcohol alone shrinks the tissue while on the other hand formalin swells it, so that in this respect the one reacts against the other.

ADHESION TO THE SLIDE.

After the infiltration and imbedding of the tissue in paraffin, the question of the treatment of the sections is one of some importance. If they are to be carried through a series of reagents in watch glasses, and not placed upon the slide until they are mounted, the sections must necessarily be rather thick, in order to withstand the manipulation. Very much thinner sections, if adherent to the slide, and consequently supported by it, can be carried through the different steps of the process without injury, and show the structural elements to much better advantage.

The albumen or collodion adhesive, usually employed for this purpose, however, possesses the disadvantage of taking the aniline colors used in bacteriology; sufficiently to disfigure the preparations. If a clean slide be coated with a thin film of glycerine and then rubbed very nearly dry with a cloth or the hand, and a drop or two of 35 per

cent alcohol be placed upon it, the section, if curled, will
tend to flatten itself when placed on the alcohol.   If the
slide now be placed in a thermostat for a few hours, at a
temperature near the melting point of paraffin, the heat
will cause any wrinkles or irregularities of the section to
disappear ; the alcohol slowly evaporates and when the
slide is thoroughly dry the albumen molecules of the tis-
sue adhere quite firmly to the slide, as noted by Gaule.
After this the slide may be heated gently over a flame
until the paraffin begins to melt. If any moisture remains
the section will be quite likely to loosen during the latter
stages.   Thick sections do not adhere so firmly as thin
ones.   The slides may then be immersed in a jar of tur-
pentine or any solvent of paraffin and carried through
the various grades of alcohol to water.

A shorter method, in which there is as firm adhesion
of the section to the slide, is to bring the slide in contact
with aniline oil for a few minutes after the treatment with
the turpentine, absorbing the superfluous turpentine with
filter paper.   The aniline oil is also removed by means
of filter paper.   The section is then thoroughly washed in
distilled water which removes the oil, and the tissue is
then stained and washed in water.   If aniline stains are
used, a hurried rinsing is sufficient.   Drain or absorbe the
water and again apply the aniline oil.   Besides clearing
the section the oil tends to remove the aniline stain and
care must be exercised in not letting this process go too
far.   Displace the aniline oil with xylol and mount in
balsam.   The color ought not to fade if the aniline oil
has been thoroughly removed.

With certain stains, or combinations of them, the ani-
line oil may not succeed in preserving the sharp defini-
tion of the color.   Under such conditions the section,
after staining, may be treated directly with absolute
alcohol to dehydrate and remove any superfluous stain.
Some aniline dyes are not as soluble in absolute alcohol

as in the weaker grades. Clear in xylol and mount in balsam.

The use of aniline oil in the treatment of the sections will be recognised as as having been recommended by Weigert for bacterial purposes. It likewise gives most excellent results in ordinary histological work and is a saving of time and material.

MOUNTING.

Many valuable specimens are ruined for the want of sufficient precaution in the preparation of the balsam. In its commercial state it contains many volatile principles and traces of acids, which, in the course of time, act upon the specimen and diminishes or entirely removes the color. All this may be lessened, if the balsam be heated sufficiently to drive off the volatile constituents, or more thoroughly obviated if a little potassium carbonate or mild alkali be added to neutralize the acid just before the balsam is heated. When the balsam becomes hard it can be broken into flakes and stored. When wanted for use dissolve in xylol to the desired consistency and filter through absorbent cotton. Specimens stained with the Biondi-Ehrlich mixture (which fades so easily) have at the end of a year shown no signs of losing their pristine clearness. *Trans. A. M. S.*

EDITORIAL.

Powders Identified by Pollen.—The Jour. of Pharmacology contains an interesting paper, by Mr. Chas. Pfister, on the pollen of some officinal herbs, his inquiry having been undertaken with the view of determining whether the powdered drugs could be recognized by means of any pollen which they may contain. Mr. Pfister's conclusion is that they can, and he submits figures and descriptions which corroborate his statement. Thus the pollen of horehound is squarish oblong, green and smooth ; that of

worm-wood smooth, elliptical, and yellowish, some grains
resembling a three-leaved clover. Mr. Pfister's notes do
not profess to be exhaustive, but they are suggestive, and
are worth following up. He mounted the pollen in sweet-
almond oil, without previous preparation, and finished
with a ring of gold size.

MICROSCOPICAL APPARATUS.

The Micromotoscope.—Dr. Robert L. Watkins says that
living microscopic objects may be presented on a screen
with an instrument which he calls a micromotoscope.
After overcoming several obstacles he found it possible to
do this directly by the use of a special arc light, but the
one great obstacle—heat—dried the specimens so promptly
that the living objects were killed and the method had to
be abandoned. The appearance of the vitascope, however,
suggested the possibility of applying some such method
to the studies he was pursuing. This proved perfectly
successful. By means of this instrument he discovered
that the active motion of living microscopic objects could
readily be photographed. By using from fifty to a hun-
dred and fifty feet of the vitascopic film, and taking a series
of impressions in sufficiently rapid succession, he has been
able to secure pictures which when passed through a lan-
tern at the same rate of speed will present on a screen all
the motions of the objects photographed, and can be wit-
nessed by an audience of any size.

Dr. Watkins thinks that the value of this discovery can
not be overestimated, not only for use in studying the vital
processes of microscopic life, but also as a method of
teaching students and the public. In his investigations,
this method has been applied more especially to the study
of blood-corpuscles, and he states that the active motion
of the leucocyte can thus be readily reproduced. It may
be seen to stretch out its fingerlike prolongations and then
retract them. The nucleus may also be seen to vary its
shape, to split up into two or more, and sometimes the cell
itself to divide into many parts.

The accurate reproduction of these various vital processes of cell life, he thinks, will be of great assistance in revealing the exact condition of the blood, and help us to get one step nearer the ultimate processes of life. Dr. Watkins does not hesitate to say that various cells now known by different names will be found to be only transition forms of the leucocyte. The amoeboid motion of the leucocyte continues sometimes for fully twenty-four hours after the blood is placed on the slide of the microscope.

There is another field of usefulness in which the micromotoscope may prove of service, and that is in the study of the life of microbes in stale urine and other fermenting fluids, and in the study of the motile efforts of all microscopic germs and bacilli.

To secure an appearance of continuous motion, these pictures must be taken in rapid succession, allowing an exposure of from one fiftieth to one twenty-fifth of a second; and to complete a full cycle of motion, as in the expansion and contraction of a leucocyte, requires from eight hundred to fifteen hundred successive pictures. The time between the first and the second photographs is two minutes; the others are fifteen minutes apart; allowing an exposure of from one to two seconds. The impression made by their rapid passage before the eye when placed in a vitascope gives the sensation of continuous motion.

MICROSCOPICAL MANIPULATION.

Separation of Diatoms, etc., from Sand.— For this purpose we use certain liquids of high specific gravity, such as are used in minerological operations, and we commend the following :

BROWN'S LIQUID: Methylene iodine, which has a specific gravity of 3.3. By adding iodoform to this, this figure is raised to 3.45, while iodine increases it to 3.65.

KLEIN'S LIQUID : Potassium-boro-wolframin, the specific gravity of which is 3.28.

ROHRBACH'S LIQUID: Barium-mercury iodine, s. g., 3.58.

TOULET'S LIQUID: Sodium-mercury-iodide, s. g., 3.19.

Other liquids are: Silver iodide dissolved in concentrated solution of silver nitrate, which makes an oily, brown liquid of s. g., 5.00. Thallium-silver nitrate, melting at 75 C., s. g., 4.1. Concerning this last named chemical the Bayerische Industrie und Gewerbeblatt has the following information:

The specific gravity and the melting point of thallium-silver nitrite fall as the proportion of thallium nitrate is increased, thus, while the latter substance has a specific gravity of 5.00, and a melting point of 250, the addition of 1 part of silver nitrate to 4 parts of the thallium salt decreases the melting point to 200 degrees C., and the s. g., to 4.9. Three parts of silver nitrate to 4 parts of thallium nitrate bring the s. g. down to 4.7 and the melting point to 100 degrees C.

All the above are soluble in, or miscible with water in every proportion. In using them the material is thrown on the liquid, and floats or sinks according to its specific gravity.—Zeitschrift fur Angewandte Mikroskopie.

Pastes and Cements for Photographs and Other Purposes.—From a recent publication on the recent progress and novelties in photographic technique, by Eder and Valenta, the Drogesten Zeitung takes the following formulae for pastes:—

PASTES CONTAINING STARCH.

Gum arabic .... 4 parts.
Starch .... 3 parts.
Sugar...... .... 1 part.
Water sufficient.

Dissolve the gum arabic in sufficient water to take up the starch; rub up together, add the sugar, and heat the whole on a water-bath until the starch is completely converted.

COLLODINE.—This is simply a paste made by treating starch with water rendered strongly alkaline, whereby the substance is rendered soluble.

TRITICINE.—This is a paste made of dextrin and starch in equal parts, in water, the starch being made soluble by

heat. A little glycerine is added to make the paste pliable and elastic when dry, and a little boric acid or thymol, or both, to prevent fermentation.

DEXTRIN PASTE—MUCILAGE.

1. Dextrin..50—90 parts.
   Alum ....4 parts.
   Sugar ....75 parts.
   Water...120 parts.
   Carbolic ac d solution, 10 per cent.........................60 parts.

Mix.

2. Gum arabic ....4 parts.
   Water...8 parts.
   Glycerine...1 part.
   Neutral spirit ....3 parts.

Mix.

3. Gum arabic..70 parts.
   Water..200 parts.
   Aluminum sulphate..2 parts.

Dissolve the aluminum sulphate in a small portion of the water, and the gum arabic in the rest, and mix the solutions. This makes a very strong and excellent mucilage, the addition of the aluminum sulphate giving it great strength and adhesiveness.

PASTES CONTAINING GELATIN OR GLUE.

The following is recommended to the trade as a most "excellent paste for every possible purpose."

Gelatin or best glue. ....2 parts.
Water..6 parts.

Pour the water over the glue and let stand over night, or until the glue is swollen and soft throughout, then put on a water-bath and heat gently until the glue is melted. Add from 1 to 2 parts of chloral hydrate and let digest under gentle heat for some time. The resultant fluid is a liquid glue of great tenacity and keeping properties. Another formula is as follows:

Best glue.. ....40 parts.
Water...100 parts.

Treat the glue as before, by letting stand over night and melting in the water-bath. In the hot liquid stir 40

parts of starch, a little at a time, with constant stirring, until the starch is converted. Then add 5 to 10 parts of oil of turpentine, and stir in. This glue should be warmed up till lurkwarm before using. Finally, a very powerful cement is made as follows:

Cover 100 parts of gelatin with cold water, and let stand until the gelatin has absorbed as much of the water as it will take up. Pour off the residual water and get rid of the last traces of surplus by throwing the gelatin on coarse cloth. Melt in the water-bath as before and to the liquid add 150 parts of alcohol, 500 parts of water, 50 parts of glycerin and 20 parts of carbolic acid.

BACTERIOLOGY.

Bacillus Coli communis.—It has been known for many years that certain micro-organisms found in animal dejecta decomposed alkaline nitrates with formation of oxygen, which is utilized by the bacteria, free nitrogen, and liberation of the base. One of these organisms is the Bacillus Coli communis, and Hugounec & Doyon have recently presented a memoir on this subject at a meeting of the Paris Society of Biology. They find that by reversing a tube of a sterilized solution of potassium nitrate in peptone, sown with Bacillus Coli over a tube of mercury, that after some hours several cubic centimeters of nitrogen are liberated by the denitrifying action of the bacillus. The nitrate solution was found to be most strongly acted upon when containing about 1.5 per cent. On testing with Eberth's bacillus similar results were obtained.

Smegma Bacillus.—Grethe (Fortschr. der Med., May, 1896) points out the need of some simple method of differentiating the smegma bacillus from the tubercle. The inability to distinguish between these two germs has led to serious results in a number of instances; in one case a supposed tubercular kidney was removed, but upon subsequent examination it was found that there was present only calculous pyelitis. In this case supposed tubercle bacilli were found in the urine. A number of other cases

have been reported in which similar errors have occurred.

Grethe has found that reliable results are obtained by staining with a concentrated alcoholic methylene blue. This stains the smegma bacillus well; and if the preparation be first stained in the ordinary manner with carbol fuchsin, the tubercle bacillus, if present, is easily identified by its red color contrasting with the blue of the rest of the preparation, including the smegma bacillus.

MEDICAL MICROSCOPY.

The Recognition of Diabetis by Examination of the Blood.—Bremer shows, in the Journal der Pharmacie von Elsass-Lothringen, how it may be effected by the aid of the microscope, in demonstrating the grape sugar reaction in that vital fluid. He says:

Mix equal volumes of saturated solutions of eosin and methylene blue and pour the mixture on a filter as soon as the precipitate ceases to fall. Collect the precipitate after washing on the filter, dry it carefully, and pulverize it very finely. To this powder add 24 parts of eosin and 6 parts of methylene blue, also in fine powder. This will make a redish-brown powder.

The blood to be examined is spread in a very thin layer over a cover-glass, another cover being smeared with a drop from some person known to be healthy, the latter serving for purposes of comparison.

After drying, put the two cover-glasses simultaneously in a mixture of alcohol and ether in equal parts, put over the waterbath and let boil for four minutes. Remove and put in a solution made by dissolving from 25 mgm. to 3 cgm. of the mixed powder described above in 10 gm. of 33 per cent alcohol (alcohol 1 part, distilled water 2 parts). This solution, we should remark, should be freshly prepared on each occasion that it is required.

Leave the cover in the stain for about four minutes, remove, rinse with water, and examine under the microscope. If diabetes be present in the person whose blood is under examination the latter will be colored a blue-

black, while normal blood, takes on a red-violet. In all cases where possible, for the sake of absolute certainty, the urine should be tested for glucose by any of the well-known reactions.

Yellow Fever Microbes.— Dr. Havelburg announces that the mirobe which he considers the specific cause of yellow fever is found only in the stomach and intestines, but is cultivated by injecting it subcutaneously into guinea pigs. He finds that a previous injection of blood from a yellow fever convalescent renders an animal immune to an otherwise fatal dose of injection of the cultivated microbe. —O Brazil Medico.

MICROSCOPICAL SOCIETIES.

Quekett Microscopical Club.

The 352nd meeting of this club was held on June 18th. It was voted to alter rule 1 of the club's bye-laws making the vacation three months instead of two, as heretofore. Meetings will be resumed in October.

R. and J. Beck exhibited a portable binocular microscope with the stage and sub-stage entirely removable for convenience in packing. Mr. Nelson did not see why this arrangement should be less practical and rigid than the more complicated and expensive revolving movement usually employed. Mr. Nelson described the performance of Leitz's new semi-apochromatic 1—10th oil immersion objective of 1·3 N. A., which he thought was the finest lens yet produced at anything like the price—viz., $18.00. He also exhibited one of his new-formula reflecting loups, and a fine series of enlargements of his well-known photo-micrographs of diatom structure. Mr. A. Earland read a paper on collecting Foraminiferous material, including directions for cleaning and mounting. Mr. Rousselet read a paper on the male of Proales wernecki—a rotifer the females of which produce galls on Vaucheria, in which they reside and deposit their eggs.
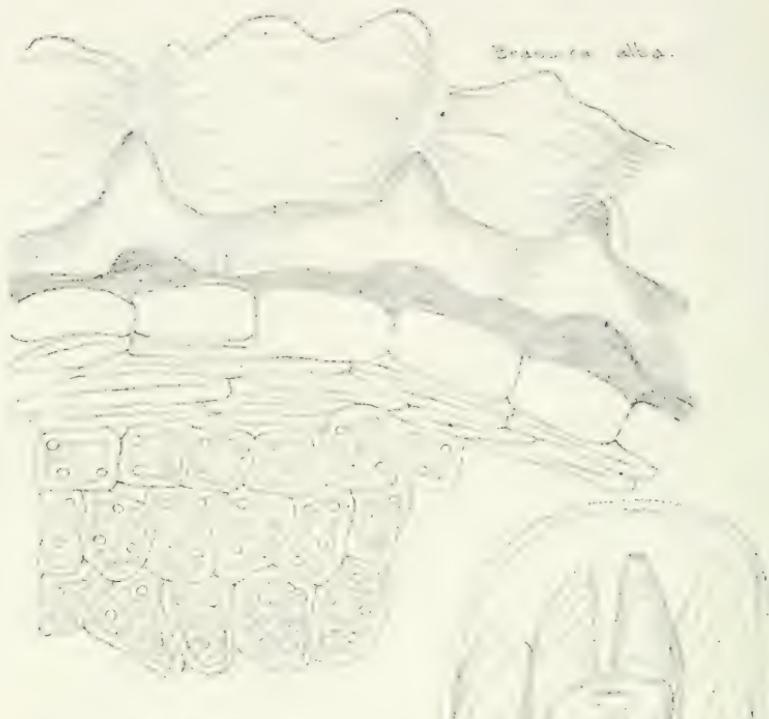
Brassica alba.

Camelina sativa.

SEEDS AND TESTA.

Public Water Supply for Small Towns.

By M. A. VEEDER, M. D.,

LYONS, N. Y.

Drinking water that is manifestly bad does not make everyone who uses it sick. Even when the mains and reservoirs of a public water-system have been infected by such a poison as that of typhoid it is only exceptionally and for limited periods that as many as one per cent of those using the water contract the disease. An outbreak of 2,000 cases in a population of 200,000 is ordinarily regarded as a severe epidemic, and yet this is at the rate of only one person in a hundred. It is this immunity on the part of the great mass of the people that permits infected systems of water-supply to continue in operation. If there were no resisting power on the part of the individual, all would die on the slightest exposure and the source of danger would be thoroughly identified and avoided. As it is, however, for every one that contracts the disease there may be as many as a hundred who escape. Thus it becomes a question of probabilities, and there is a chance for much plausible theorising and controversy. Gradually, however, as the result of increasing observation and experience, crude ideas that have prevailed are being eliminated and the truth of the matter established.

Only a few years ago the most essential point in the mprovement of water-supply was thought to be the

determination of the chemical ingredients held in sus-
pension or solution. Elaborate systems of analysis were
devised for this purpose, and the quality of the water
was judged almost entirely by its chemical reactions.
Thus it becomes customary to consider the questions
involved from a chemical point of view exclusively. The
simple dilution of contained matters of a chemical nature
if carried far enough, would make them harmless. Con-
sequently large bodies of water were supposed to have a
power of self-purification in direct proportion to their
size. In like manner precipitation, sedimentation, aera-
tion and other chemical and mechanical processes were
supposed to have a purifying effect. The quantity of
sewage entering a stream being known, it becomes possi-
ble to tell with a good degree of certainty at what distance
mingled with such a volume of water, it will become so
diluted, diffused and changed as to be unrecognisible by
any chemical test. The dose of poisonous matter, if of
a chemical nature, ought to be divided and sub-divided
to such an extent as to be entirely harmless in the quan-
tity of water that any individual would consume. In
practice, however, this is not found to be the fact, sewage
infection being capable of producing epidemic disease
for many miles along a stream entirely out of proportion
to any possible chemical process of diffusion.

The whole tendency of modern research has been to
show that the question as to the spread of disease through
the agency of water is biological rather than chemical.
It is the presence of certain living organisms and of the
conditions on which their continued existence depends
that leads to the spread of disease. A single seed may
be the means of overspreading an entire continent with
some form of luxuriant growth, and so a single disease
germ may start an epidemic, not through any mechanical
or chemical process of division or subdivision, but because
having life it grows and multiplies.

The danger consists not in the quantity of such organisms but in their power of growth under given conditions. If capable of living in water, they may infect an entire stream instead of disappearing by processes of dilution within a few rods. Unlike chemical poisons, they have no fixed poisonous dose. The smallest possible inoculation may prove fatal through the power of self-propagation which they possess. If, on the other hand, their growth be hindered by unfavorable temperature, moisture or food supply, they may become harmless no matter what their quantity. It is true that they have chemical effects, originating substances known as toxines, some of which are deadly poisons, but they themselves depend upon possession of life for the modes of activity which they exhibit. Throughout it is a question of vitality under particular surroundings.

Typhoid fever, cholera and certain forms of dysentery are the chief diseases whose infection it is generally admitted can live in water. In addition, about ten years ago, the writer came to the conclusion that the term malaria, signifying bad air, is a misnomer, and that diseases of this class are very largely, if not exclusively, conveyed in water. Towns taking their public water-supply from ponds or streams having distinctly malarial surroundings have become subject to such fevers although previously free from them.

The manner of spreading of the diseases which have been named originates two classes of dangers. If water be taken from the vicinity of human habitations there is liability to contamination from excreta washed into the pond or stream used as a source of supply, or, in the case of wells, the strong action of powerful pumps may originate a rapid flow underground extending many hundreds of feet and carrying impurities through coarse gravel or open crevices in the soil. That this is the fact appears from the manner in which ordinary wells at a considera-

ble distance from the pumping station run dry when the latter is in operation. Such contamination from human sources may originate typhoid and diarrheal disorders. If, on the other hand, the source of supply is remote from human habitation there may be malarial contamination. Indeed the natural habitat of malaria is in new and undrained countries and virgin soil. In view of this distribution of the disease it is surprising that well-drained cities, having perfect sewers, should yield a certain percentage of malarial fevers until the source of their water-supply is noted, it being in such cases, as a rule, some pond or stream in whose vicinity these diseases are prevalent. Shallow wells in alluvial soil also may yield malarial infection. It is said that since the substitution of deeper artesian borings for such wells there has been a notable decrease of malarial diseases in some parts of the Southern States of North America.

In many localities it is difficult, if not impossible, to secure an adequate supply of water free from the forms of contamination to which reference has been made. This necessitates some system of purification.

It has been discovered recently that there is an antagonism between disease germs and what are known as nitrifying organisms, which produce nitrates and nitrites in the soil. Advantage has been taken of this to institute an intermittent process of filtration. Water containing the bacteria that it is desired to destroy is allowed to run into a filter composed of sand, containing an abundance of nitrifying organisms, and instead of being drawn off immediately is allowed to stand for a sufficient length of time to permit the destruction of the disease germs by their natural foes.

Such filtration as that just described is but the perfecting of natural processes. Alternation of rainfall and dry weather operates substantially on the same plan, tending to purify the ground water in the soil from infec-

tion and making wells possible.   Thus in localities where
artificial filter beds are impracticable it may be possible
to resort to wells with similar results.   Experimental
borings are required in order to determine whether the
quantity of water is adequate and whether the soil through
which it percolates is adapted to secure its purification.
This being done and the system established, the inter-
mittent action of the pumps, running a part of each day
like intermittent filtration, yields a much purer supply
than could be had in any other way.   A point to be
guarded against is the influx of surface water, which is
specially liable to contain malarial infection as well as
other impurities.   To this end, numerous small wells,
consisting of iron pipes put down to the proper depth
and having perforations over a space of six or eight feet
from their lower extremities, covered with fine wire
gauze, may be employed.   Another plan that may serve
is to have a single large well, twenty feet or more in
diameter.   A convenient method of construction of such
a well is by the use of a curb, built up in a hexagonal or
octagonal form, of plank laid flatwise and spiked one upon
the other in layers.   If such a curb be made, slightly
smaller towards the top, it can be carried down success-
fully through almost any sort of soil and stoned up.

It has been thought best to enter somewhat into such
details as have been indicated, because they illustrate the
principles involved in improvement of water supply,
especial reference having been had throughout to locali-
ties whose resources are limited.   The adaptation of
laboratory results to practical uses is the point specially
sought to be accomplished in this brief summary.   The
sanitary engineer, the practising physician and the
skilled microscopist are upon common ground in these
studies.

At the present stage of progress it must be admitted
however, that serious imperfections are unavoidable in the

best systems of water-supply available in many localities. This being the case, household methods of purification require to be taken into the account. That preferred by the writer is as follows: The water is boiled and allowed to stand in a covered stone jar until all sediment has deposited. It is then transferred to ordinary air-tight glass fruit jars, a lot of which, having convenient modes of fastening, are kept for the purpose. When put in an ice chest or cool cellar such water comes out beautifully clear, sparkling and palatable. Such water has no unpleasant flavor unless kept too long, and even this might be avoided by sterilising the jars and filling them with the water while hot, which would require reheating after the sediment is removed. Practically there is no necessity for this extra trouble. Certainly all the waters treated by the writer in this way have proved to be excellent, and there can be no question as to their freedom from the infection of any of the diseases that have been named in the discussion. It may be noted also that substantially the same principle is employed when water is used for quenching thirst in the form of tea, coffee, soups and the like. It is the boiling that makes such waters safe, the various ingredients added serving to please an acquired taste for the most part. Mankind is accustomed to take many precautions of this sort without any clear ideas of the reasons. It is the province of advancing civilization to enable such precations to be taken intelligently, and consequently more perfectly, and this is the aim of the present discussion in regard to water-supply.—Proc. A. M. S.

Exchange.—H. W. Parritt, 8 Whitehall Park, N. Loddon, England, wishes to exchange microscopical slides, books and objects for crustaceans, echinoderms, sponges, zoophytes, shells and other marine objects, fresh or dried.

The Brain of the Embryo Soft-Shelled Turtle.

SUSANNA PHELPS GAGE, Ph. B.,

ITHACA, N. Y.

In a paper read before the Microscopical Society last year, upon the "Comparative Morphology of the Brain of the Soft-shelled Turtle (Amyda mutica) and the English Sparrow (Passer domesticus*)," certain questions were raised, which could only be answered by studying the development in the soft-shelled turtle, as : When and how do the characteristic features of the brain in this group of turtles arise ?   When and how do those features arise which distinguish them from birds ?

Professor Eigenmann, who was present, kindly sent me six embryos of Aspidinectes, a closely allied genus of the turtle, in different stages of development.   Serial sections were made of the heads and mesal views reconstructed.   A brief summary of the result obtained is given below.   Fuller statement, with illustration, is reserved until more material is studied.

The body of the youngest specimen was 7 mm. long ; the form generalized ; the face short; the diameter of the eye, one-half the length of the head.   A narrow carapace was distinguishable in a specimen, with length of body 11 mm.   In the oldest specimen the carapace was 16x11 mm., and had the characteristic leathery appearance and markings of the adult.   The snout had also the elongated form of the adult.   The feet were webbed. The diameter of the eye, though twice as great as in the youngest specimen, was only one-third the length of the head.

1.   As seen from the meson, the most striking difference between the early and late forms of the brain is the general shape.   Taking as reference points the

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* TRANSACTIONS American Microscopical Society, Vol. XVII., 1895, pp. 185—238, 5 plates.

center of the geminum, the union of the myel with the oblongata and the tip of the olfactory lobe, in the youngest embryo, the figure formed is an isoceles triangle, in the succeeding stages changing to a flattened triangle by the elongation of the base. The cephalic limb of the triangle increases greatly, while the folding of the caudal part of the brain produces an actual shortening of the caudal limb of the triangle In the adult Amyda the flattening of the triangle has proceeded to an extreme. The change of form in the brain is apparently greater between the time when the external appearance of the adult is established,as in the oldest embryo, and the true adult condition, than between the oldest and youngest of the above described embryos. This is due to the fact that after the external adult appearance is complete the cerebrum and the cerebellum both acquire their largest comparative growth.

2. At the constriction occurring in the brain-tube, between the postcommissure and the floor of the cranial flexure, the brain shows the least increase in size, as shown by different measurements upon the meson of the embryo and adult brain. This stationary condition is probably due to the early maturing of the region.

3. The union of the olfactory lobes across the meson was not found in these turtles until the beginning of the carapace was distinguishable, and did not present the comparative extent and close connection of the adult until the oldest embryo had the adult appearance. That is, as was found with the sparrow, the union across the meson is of late occurrence and secondary importance.

4. Those parts of the cerebrum, apparently connected with olfaction, the hippocampal, progress with equal step with the olfactory lobe, and not until the oldest embryo is the fimbrial edge of the hippocamp and its union across the meson, the fornicommissure, well established. The late appearance of this commissure is con-

sonant with great variation in different types, but this study tends to corroborate the opinion now gaining ground, that this commissure in the lower vertebrates is not a callosum.

5. That part of the cerebrum so prominent in the adult, the caudatum, or elevated portion of the striatum, is only found as a rather inconspicuous object in the oldest embryo, but the precommissure, in which fibers from the upper parts of the striatum cross, arises as the carapace begins to form.

6. In the roof of the brain the postcommissure is a well-formed landmark in the earliest of the embryos, while the commissure, bounding the opening of the epiphysis, the supracommissure, shows as a mere trace in the youngest embryo and attains a disproportionate development in the oldest. A similar culmination in growth is seen in the oldest embryo in the associated epiphysis, habenae and the fiber tract extending from this region to the cerebrum, a fact apparently indicating that in ancestors of this group having comparatively simple brains these parts were of more importance, for in the adult turtle they are overshadowed by the later developing parts.

7. The membranous roof in all embryos is a simple unfolded membrane, clearly continuous with the paraplexuses of the cerebrum. The latter, in the early stages, are simple membranes, which show folds only when the carapace begins to develop, and become quite complex in the oldest embryo. The paraphysis, at the point of union of the diaplexus with the paraplexuses, is a widely open tube in all the stages, and becomes early convoluted.

8. The medicommissure, a feature which is found in mammals and reptiles, but not in birds, arises in this turtle only in the oldest embryo, in this being like mammals, in which it also appears late, and showing that

though characteristic, it is of secondary importance.

9.   In the infundibular region of the embryo are seen distinct folds and pits, which are nearly obliterated in the adult.   A pair of protuberances, dorsad of the hypophysis, occurs in the younger forms, and is represented in the adult by a single mesal notch.   Dorsad of the hypophysis, occurs in the younger forms, and is represented in the adult by a single mesal notch. Dorsad of these a mesal protuberance, lying between two commissures, is much more prominent in the younger specimens before the commissures are formed.   The decision upon homologies of these protrusions of the wall with either the albicans of the higher forms or the hypoaria of fishes must be reserved, there are details of difference in both.

10.   In the turtle, all parts connected with vision are well developed.   In the youngest embryo the optic recess is clearly traceable to the eye along the optic nerve, as the remains of the originally open vesicle. This remnant becomes more convoluted, the endymal cells giving an almost glandular appearance, in the stages when the carapace begins to develop.   In the oldest embryo this appearance is gone, but the numerous cells of the chiasma in the adult may represent this convoluted vesicular remnant.

11.   The optic geminum does not lose the form of a thin roofed single vesicle until in the oldest embryo a mesal depression occurs, forming the paired geminums, and at the same time an extensive union across the meson by means of the geminal commissure, and a division of the cells into two layers arise.   The late formation of this solid roof of the geminums is interesting in connection with the fact that in birds the roof is a membrane.

12.   In the latest embryo the cerebellum is only just beginning its growth as a great mesel feature, though considerably· earlier it is apparent as a lateral organ. In the youngest embryo its appearance is like that of

the *Amphibia*, having a small mesal portion. With its growth caudad it revolves, so to speak, about a fixed point, carrying the thin membranous wall before it, and thus forms the folded metaplexus of the adult. The oldest embryo shows this admirably.

13. The floor of the oblongata undergoes wonderful changes, from a comparatively thin-walled condition in the youngest embryo, through one in which series of rounded thickenings occur, these in turn becoming united, as the carapace developes, to form the continuous thickened floor of the oldest embryo.

From the above it is seen that partial answers to the questions mentioned are now possible.

(a.) The general form of the brain of the soft-shelled turtle wherein it differs markedly from the other described turtles is only acquired after the embryo has the external appearance of the adult, the great relative growth of the cerebrum and cerebellum taking place after that period. (Sec. 1, 2.)

(b.) The union of the olfactory lobes across the meson and the large caudal growth of the cerebellum seem to be characteristic of this group of turtles, and it was found that both are of late development. (Sec. 3, 12.)

(c.) The broad distinctions between the bird and reptile brain are, that the latter possesses a medicommissure and a solid roof to the geminums; in the soft-shelled turtle both of these features arise in the late embryo.

That is, in the brain not only those features which distinguish the group of turtles, but which most evidently distinguish birds from reptiles, arise in this turtle about the time the external form is characteristic of the genera. The brain, however, lags somewhat behind the body in assuming characteristic features.

Other questions arose as to the appearance of the nidi and their relation to sulci, which cannot yet be answered conclusively.

On the Seeds and Testa of Some Cruciferæ.

By L. H. PAMMEL.

AMES, IOWA.

WITH FRONTISPIECE.

Continued from page 274,

CAMELINA SATIVA, CRANTZ.

Pod obovoid, four to six lines long, smooth, reticulated, margined from beak down along placental side with smaller ribs between them. Seeds light brown, one line long, minutely pitted, caulicle prominent, running lengthwise with a prominent groove between it and the cotyledons. Cotyledons incumbent.*

Seed coats consisting of four layers. The outer epidermal cells not much longer than wide, on the addition of water become mucilaginous and well stratified. On the addition of chloral hydrate stratification more evident. The cell-walls differentiated into several different substances. The second layer not always developed. Cells of third layer with thick walls and brown pigment, followed by a narrow layer of thick walled brown cells. The first row of cells of endosperm, rather thick walled, filled with protein grains, the other layers of unequal development, cells elongated, thickwalled; followed by cells of embryo; these contain protein grains and fat.

EXPLANATION OF THE FIGURES.

I.   July text, page 209, (Reprint, page 7). Brassica nigra: a, mucilaginous cell before the addition of water; b, after addition of water; 3, brown thick-walled cells; 4, parenchyma cells; 5, aleurone layer; 5-6, endosperm; 7, cells of embryo. B. sinapistrum: c, mucilage cells expanded; 4, endosperm in figure to the left, embryo in figure to the right.

II. September frontispiece (Reprint, page 12). Sisymbrium altissimum, S. officinale and Capsella bursa-pastoris: The upper row of cells consists of mucilage cells; the lower row contains embryos; about midway between may be seen the endosperm.

III. September text (Reprint, page 13). Lepidium virginicum. 1, mucilage cells; 3, 4, endosperm; 5, cells of embryo; b, mucilage cells when moistened.

IV. October frontispiece (Reprint, page 15). Brassica alba: Upper row, mucilage cells; third and fourth rows, endosperm. Camelina sativa: upper

*Harz. l. c. p. 924. Fig. 71.

row, mucilage cells; third row, thick-walled cells; fourth row, aleurone cells; lower row, cells of embryo.   Figures on right of plate, mucilage cells when moistened.

All the figures were drawn to the same scale.—X320.

A Partial Bibliography on Mustard Seeds.

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A Cause of Foul Water in Reservoirs.

By ARTHUR M. EDWARDS, M. D.,

NEWARK, N. J.

To the presence of a bacillarian, a diatom in fact, is due a certain fouling of drinking water. Prof. Leeds, of the Stevens Institute of Technology has given to it the name of Asterionella flavor. In the report on the city water of Brooklyn, N. Y. it is detailed. The results arrived at are microscopically and technically of great value.

By order of the board constituting the department of the city works, on September 4, 1896, the Engineer was requested "to make such examination of the Brooklyn water supply as he should deem necessary, in order to determine the cause of the complaints made in regard to its quality, and the remedy to be applied.

Daily examinations showed that immediate action was necessary. The objectionable appearance, taste and odor during the mid-summer periods has been essentially due to the protista, a plant growth known as Asterionella.

It has nothing whatsoever to do with artificial causes like drainage, sewage or contamination. It is due to purely natural causes, the first being the microscopical chemical constituents of the water, and the second, and even more important, being the physical conditions in which the water is placed after entering the reservoirs. The important questions to consider are:

I.   What is the Asterionella, and what is peculiar about it ?

II.   What is there in the composition of the Brooklyn water, or the mode of handling and storing it, that has fitted it especially for the development of the Asterionella?

III.   How can growth of this organism be prevented ?

I. Asterionella derives its name from its form, being a star-shaped organism usually 3– or 4–rayed. It is a diatom, a bacillarian, usually called an alga, although more properly called a protiston. The latter is distinguished from most other algæ by being enclosed or having a skeleton or envelope capsule of silica, or soluble silica hydrate. This particular genus has the further peculiarity of secreting a substance in the nature of an oil which possesses a taste and odor so characteristic that, for lack of a better name, is is called Asterionella flavor. It is a combination of fishy, salty and oily tastes, its odor resembling that of certain varieties of geranium.

Although some of the samples of the reservoir water contained as many as twenty million individuals to the gallon, yet it would require many hundred gallons of the water to get enough of the oily product which imparts taste and odor, to work upon in the laboratory to accurately determine its nature. In many of its properties it resembles trimethylamine.

In the month of August, when the trouble was at its worst, the water had a white appearance and was filled

with minute white threads. On standing, it threw down a floculent deposit of a stringy, whitish or yellowish white matter. Under the microscope, this deposit was found to consist of innumerable Asterionella matted togetehr with other diatoms strung together in threads the other diatoms, being more especially Melosira, Tabellaria and Synedra. These thread-like forms have not been noticed to produce the objectionable taste and odro secreted by the Asterionella, and, moreover, they were vastly less abundant. The water itself was colorless, the apparent color being due to the suspended organisms. The oily taste-producing substance is volatile and cannot be gotton rid of by distillation. It distills over with the steam, giving to the distilled water a faint whitish appearance or opalescence, and communicates to it the same characteristic taste and smell.

Neither can it be got rid of by filtration through paper or cotton or a thin layer of sand. Sand will arrest nearly all the Asterionella and then on being washed with pure water, the water used in washing and containing the plant will be found to have taken up the taste and odor. To remove both the Asterionella and all the taste and odor arising from it, it is necessary to filter through animal charcoal or thorough a properly constructed sand filter of sufficient depth.

The most characteristic feature of the diatom is its envelope of silica. There are many other kinds of microscopic organisms represented in the different portions of the Brooklyn water supply, such as green algæ, the bluish green algæ and the fungi, Rhizopods, Rotifers, Crustaceans, etc., but none of these are characterized by the presence of silica, and do not in the same sense imperatively demand it as a constituent of their food. Moreover, the number of non-silex-secreting organisms is insignificant when compared with the stupendous number of diatoms. Thus Prof. Leeds says, but he for-

gets that the silica in the loricæ of bacillaria, or diatoms, is in a very soluble form and bacillaria are also present in all water, marine, brackish and fresh, the world over. Silica can also be dissolved when in the crystaline form, as clear, transparent rock crystal. It is very likely that in this manner silica comes into solution and not by the action of alkali, potash or soda, which are also common in all soils. But, he says, "such being the case there must be a great abundance of dissolved silica in the Brooklyn water, and something in the nature of the water-shed which enables it to impart the silica. As a matter of fact, the ponds and streams contributing to the Brooklyn supply have sides and bottoms of sand, which is silica in an undissolved form." But silica is always soluble! "Moreover all the water has an alkaline reaction and is capable, therefore, of dissolving silica and holding it in a soluble form. The wells, indeed, are the chief source of the silex of the Brooklyn water. The complete analysis of the mineral constituents given later shows the wells to contain 1.5 parts per 100,000 of silica. But by dilution with the surface waters containing relatively less, the silica in the combined supply is only about half as much. But even then, it amounts to 9 per cent of the total mineral matter present. This large amount is more than ample for the nutriment of the enormous number of silicious algæ which thrive and multiply in the Brooklyn resevoirs and distributing mains.

Where do these Bacillaria come from? A microscopical examination of the water from several Brooklyn shallow wells, shows a few Bacillaria, the Asterionella, however, being found but once. From one basin however they were plentiful, being 6,400 per cubic centimetre. The sample taken from the centre, but at the bottom of the resevoir, at the same time, contained 11,616 and the efflux 9,552 Asterionella.

Besides the silica, what else in the way of food do the

Bacillaria require? Multiplied observations in many localities have shown that such a stupendous growth as the reservoirs exhibited last summer is possible only when there is present an abundant supply of food in the form of assimilable nitrogen.

Why should this transformation of ammonia, nitrites and nitrates into nitrogen and the immense multiplication of Asterionella take place in the reservoir, and not in some pond or stream where Asterionella are found, and where abundance of food is likewise present? To explain this it is necessary to have recourse to what is known of the habits of life of the Asterionella in cases where its enormous multiplication, along with the accompanying taste and odor have been observed. Its multiplication is essentially favored by abundant access of light; by a gentle, tremulous motion in the water, and by storage in shallow reservoirs. All of these conditions exist in an convenient degree in the Brooklyn reservoirs. Together with the kind and quantity of food they are ample to explain what occurred in an aggravated form last summer, what is observable now, although to a far lesser extent, and what will occur at different seasons in the future until the physical conditions that render the occurrence possible have been removed.

So far as is known the only remedy which has proved effectual has been that of excluding the light, and converting the reservoir into a substantially subterranean basin. The proposal to aerate the water, which was advocated last summer, was fortunately, not entertained. Prof. Leeds speaks with the more positiveness upon the subject inasmuch as he introduced the mechanical aeration of water supplies, and has seen its introduction followed by the happiest results in cases where conditions favorable to stagnation were dominant. But the reverse of such conditions exists in the present instance, and the aeration of the water in the Brooklyn reservoirs

with its accompanying large expense, would result only
in intensifying the trouble. Neither will filtration of
the waters before they enter the reservoirs answer. In
fact he thinks that the Asterionella is the chief cause of
the trouble. I have taken the above facts from Prof.
Leed's report and commend it to the attention of every
one interested in pure drinking water.

Prof. Leeds says that the Asterionella flavor is from a
substance which in many of its properties resembles
trimethylamine, and trimethylamine occurs somewhat
widely distributed in nature. Thus, for instance, it is
found in various plants, as the Chenopoderium vulvaria,
Annica montana, Murcurialis annua, the bloom of the
hawthorn, that of the wild cherry, and of the pear, as
well as in ergot, and other fungi parasitic on cereals. It
also occurs in various animal liquids, and especially in
herring-brine. It is likewise found as a product of de-
composition of various alkaloids, and amongst the pro-
ducts of dry distilllation of nitrogenous, organic matter
and of wood. It has a powerful and penetrating char-
acteristic fish-like smell. I have found it as a character-
istic twice of Asterionella in the season when ovulation
takes place and it seems to be characteristic of the en-
largement of the oil globules as they are called, or ova
as I designate them.

The reproduction of the Bacillaria seems to be this:
As the individual is found, it contains, besides endo-
chrome, or olive-colored matter, large oil globules which
are transparent and look extremely like drops of oil.
These are colorless and permanent so that when the
Bacillarian individual is dried up the endochrome withers
away but the oil globule stays and when the individual
is acted upon by acid, the oil globule is not so readily
acted upon. These I shall show are ova or female organs,
as the individual opens there appear certain minute dots
which are extremely active in motion. They increase in

quantity and at one stage occupy a large part of the interior of the frustule, the endochrome withering away or being crowded to the sides.   As the breeding season approaches the interior is often dotted by innumerable active little globules and two or sometimes more ova or oil globules.   Then in some way the contact of the anthozoa, as I have called these active little globules, and the ova takes place.   How, I know not for they are ex-
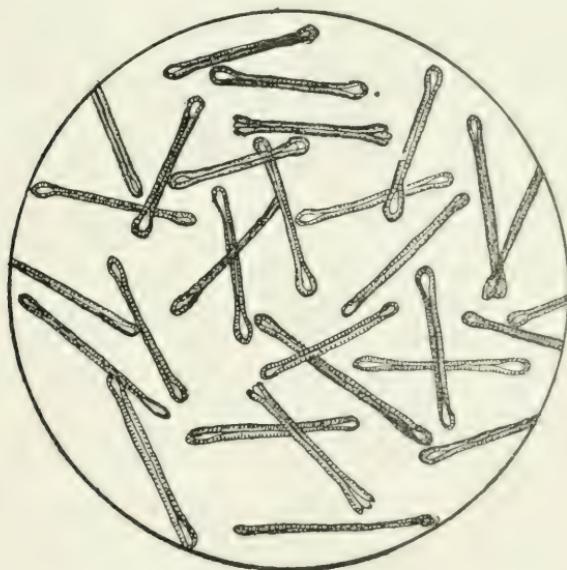
Asterionella flavor.

tremely minute and the contact is only momentary.   But sometime, I think that I shall see how the contact takes place.   At this time, or evolution, the characteristic odor, the formation of trimethylamine smelling, takes place. This is the ovulation of Bacillaria.   It takes place in all forms more or less, but is most rapid in forms which occur in such enormous quantities.   This form I have found to be as rapid as any in coming and going.   Perhaps it is more so than other Bacillarian.

The Microbe of Yellow Fever.

BY GIUSEPPE SANARELLI, M. D.

MONTEVIDEO, URUGUAY.

The best way to demonstrate not only the presence, but also its special tendency to arrange itself in small groups, preferably in the blood capillaries, consists in placing in the incubator, at 37° C. for twelve hours, a fragment of the liver taken from a fresh cadaver in order to favor the multiplication of the specific microbe. The yellow-fever bacillus grows sufficiently well in all the ordinary culture media. In common gelatin it forms rounded colonies, transparent and granular, which during the first three or four days present an aspect analogous to that of leucocytes.

The granulation of the colony becomes more and more pronounced, appearing ordinarily as a nucleus, central or peripheral, completely opaque; in time the whole colony grows entirely opaque. It never liquefies gelatin.

In beef bouillon the bacillus grows quickly, without forming either pellicles or deposits.

On blood serum solidified it grows in a manner almost imperceptible.

Cultures on agar-agar represent for the "bacillus icteroides" a means of diagnosis of the first order; but the demonstration by this means of diagnosis is efficacious only under certain determined conditions.

When the colonies grow in the incubator, they present an appearance that does not differ from that of the majority of the other species of microbes; they are rounded, of a slightly iridescent gray color, transparent, even in surface, and regular in outline.

If, instead of causing the colonies to grow in the incubator at a temperature of 37° C., they are allowed to evolve at a temperature of from 20°–22° C., they appear like drops of milk, opaque, projecting, and with pearly

reflections; that is to say, they are completely distinct from those grown in the incubator.

These different modes of evolution can be used for diagnosis by exposing cultures, first, for from twelve to sixteen hours to the temperature of the incubator, and afterward for other twelve to sixteen hours to the temperature of the air.

.This done, the colonies show themselves to be constructed with a flat central nucleus, transparent and azure, having a peripheral circle prominent and opaque. This peculiarity, which may be considered specific, may be made evident in less than twenty-four hours, serving thus to establish the bacteriological diagnosis of the "bacillus icteroides."

Apart from this morphological characteristic, which suffices of itself to differentiate the microbe of yellow fever from all others previously known, the "bacillus icteroides" is endowed with some interesting biological qualities.

It is a facultative anaerobe, and does not resist the Gram stain; it ferments insensibly lactose, more actively glucose and saccharose, but is unable to coagulate milk; it does not produce indol, and is very resistant to drying; it dies in water at $60°$ C. or after being exposed for seven hours to the solar rays, and lives for a long time in sea water.

The microbe of yellow fever is pathogenic for the greater number of the domestic animals. Few microbes have a pathological dominion so extended and so varied. Birds are completely refractory, but all the mammiferous animals upon which I have experimented have shown themselves more or less susceptible.

But of all the animals, that which lends itself best to showing the close analogy, anatomically and nosologically, between experimental yellow fever and human yellow fever, is the dog.

The virus should be injected into a vein. The morbid process that results manifests itself almost immediately, with a violence of symptoms and an assemblage of lesions which recall the picture, clinical and anatomical, of human yellow fever.

The lesions found after death are extremely interesting, as they are almost identical with those observed in the human cadaver.

Attention is called before everything to the intense fatty degeneration of the liver. The hepatic cell, examined in a fresh state with a little osmic acid, appears completely turned into fat, as it is in human victims of yellow fever; the yellow-fever toxin, as we shall see later is a true specific poison to the hepatic cell, as are phosphorus and arsenic. A complete fatty degeneration of the liver may be affected by injecting directly into it, through the abdominal parietes, a fresh culture of the specific bacillus.

The kidney shows a severe fatty degeneration, accompained by lesions of acute parenchymatous nephritis, which may be considered the direct causes of the anuria and the uræmic intoxication.

The digestive apparatus shows lesions of hemorrhagic gastro-enteritis as intense as those caused by poisoning with cyanide of potassium. They are completely analogous to those in man, though more grave.

A bacteriological fact of great interest in the yellow fever of the dog is that in the majority of cases the "bacillus icteroides" is found in the blood and the organs in variable quantity and in a state of absolute purity; at times, it is found associated, as in man, with the coli bacillus and the streptococcus.

As the tendency to secondary microbic infections has been proved even in the yellow fever intoxication of the dog, provoked with a pure culture, filtered, it must be concluded that the yellow fever poison, whether by itself

or whether through the alterations it produces in the different viscera, and especially in the liver--which, as is well known, should be considered the organ of defense against microbes—favors in the dog secondary infections having their point of departure in the intestinal canal.

This is an important point of resemblance between the yellow fever of the dog and that of man.

From the results of the first part of the investigations relative solely to the comparative morphology, biology, and pathology of the "bacillus icteroides," we can deduce some fundamental conclusions concerning the etiology and the pathology of the yellow fever of man.

Yellow fever is, then, an infectious disease, due to an organism well defined and susceptible of being cultivated in the common artificial nutritive media.

The micro-organism, which I have designated provisionally with the name of "bacillus icteroides," can be isolated, not only from the cadaver, but also during the life of the yellow fever patient.

Its isolation presents generally difficulties, sometimes invincible, due in part to the constant presence of secondary infections, and in part to the relative scarcity of the organism in the body.

These secondary infections, due almost always to certain species of microbes, as the coli bacillus, the streptococcus, the staphylococcus, the proteus, etc., may appear in the organism long before the death of the patient, which is often attributable to their action rather than to that of the "bacillus icteroides."—*Med. Record.*

EDITORIAL.

Benjamin F. Quinby, of Chicago, died suddenly at Goshen, Ind., July 18, 1897, aged 62 years. He was born in Concord, N. H. and moved to Chicago in 1853, having previously been in a wholesale grocery in Philadelphia. For twenty years past he has been in employ of Fuller, Fuller & Co.

He was active in scientific matters and was one of the oldest members and at one time president of the Illinois State Microscopical society. He was also a member of the Academy of Science of Philadelphia, and that of Chicago, and of the Royal Microscopical society of London. He was well known as an entomologist and his microscopical preparations on insects were known in many other places than Chicago.

Life in Diamonds.—Professor von Schoen, of the faculty of Naples University, and Professor Edward Von Holst of the Chicago University, propose to obliterate the line of demarkation between the organic world and diamonds. They have made photomicrographs, which views, says the Mineral Collector, show the crystal in its birth, the head showing forth from the mother crystal, and the course is followed as it pushes out and away. The crystal meets another one from a different mother. The two strike at each other, they fight, strive and clasp with each other. It is a case of the survival of the fittest. One must die. No two crystals from the same mother ever fight, however, no matter where they meet.

MICROSCOPICAL APPARATUS.

Photo-Micrography.—The following is perhaps the most simple method of doing what is required. Take a smoothly-planed board about 3ft. by 6in. by ¾in., and straight down the center thereof cut a slot about 2ft. long by ½in. wide, and lastly, affix on the under side, at each extreme end, a fillet about 1½in. wide by ¾in. thick to strengthen the board and raise it slightly from the sur-

face on which it is to stand, level and firm.   As the camera to be used only extends 9in., a box-like extension piece—adding, say, an extra 4in.—should be made and fitted to the front.   The camera is secured to one end of the board by means of a usual tripod screw passed from beneath through the long slot, and the microscope is so placed, turned horizontally on its stand, that the eyepiece points centrally through the usual lens *mount* into the camera, the junction between the two being made light-tight by a small velvet sleeve having elastic bands at each end.   The ordinary focusing-screen is utterly useless for micrographic work, it being necessary to use a piece of thin patent plate glass, having lines ruled on one side with a diamond.   Correct focus is obtained when these lines and the image are seen in focus together through a compound focusser.   The condenser and lamp (if the last is used) are, of course, arranged at the other end of the board opposite the microscope and camera.

MICROSCOPICAL MANIPULATION.

Staining Insects' Wings.—Dr. Brodie has given much attention to the setting up and preservation of insects. The following mode of staining the wings of insects which he has devised, will be both useful and interesting. Place the whole insect in a strong alcoholic solution of fuchsin, and allow it to remain there for forty-eight hours.   Then transfer the insect to water with a pair of fine forceps, and wash it until no more color comes away, changing the water if necessary. While the washed insect floats in clear water, slip a microscope slide, holding the insect on it with a fine needle, separate the wings from the body with a fine scalpel, and remove the body.   Float the wings into position on a drop of clear water, remove excess of water with blotting-paper and allow to dry.   Then place a drop of thick Canada-balsam near them and heat over a spirit-lamp. Tilt the slide to allow the liquefied balsam to flow over the wings, lower a cover-glass gently into position and allow to cool.   On examination the veins will be found red, the

depth of coloring varying with the length of time of stain-
ing, the thickness of the veins, etc.—Science-Gossip.

BACTERIOLOGY.

Anthrax Bacteria in Hides from China.—During the
early part of August four deaths occurred among the
employes of the Falls Creek tannery near Dubois, Pa.,
and several cases of severe illness have been reported.
Some time ago the tannery company received an invoice
of 100,000 hides imported from China. During the pro-
cess of tanning the liquors drained into the creek. Not
long afterwards several head of cattle running at large
died. It was discovered that the cattle drank water from
the creek. Shortly afterwards several employes were
taken sick and in some cases death resulted.

Investigation revealed the fact that the hides were infec-
ted with anthrax bacteria. Considerable alarm was
caused at Falls Creek over the fatal effects and possible
spread of the disease as it proves fatal in from five to
eight days, and of the men affected only one has so far
recovered.

The matter has been kept as secret as possible, but it
is understood that the matter has been reported to the
State board of health and an investigation will be instituted.

Pathogenic Organisms and Living Plant Tissues.—Sev-
eral years ago Dr. H. L. Russel published an interesting
paper on "Bacteria in their Relation to Vegetable Tissue"
in which it was demonstrated that some of the forms
adapted to a saprophytic mode of life may live for consider-
able periods of time in living plants, but few of the facul-
tative parasites were able to thus live. Bacillus pyocyaneus
oval schweine senche bacillus did so for some time. These
micro-organisms were usually found intracellular. Dr.
Karl Kornanter, who has recently investigated this ques-
tion, makes no reference to this excellent paper. Kornan-
ter worked with pathogenic and saprophytic species. In
the case of anthrax bacillus and Streptococcus pyogenes
the germs did not penetrate the tissues of corn or pea, in

germination the young plants having passed through cultures containing these organisms. Nor were his results with other pathogenic saporphytic organisms more favorable where onions or hyacinth bulbs were used, or when cultures were inoculated into plants above ground. Various minerals speedily destroyed the organisms. It is not probable therefore that pathogenic bacteria are ever taken up by the roots of plants.

Appropriation of Free Atmospheric Nitrogen.—Nitrogradsky is well-known on account of his extended and thorough studies of micro-organisms in connection with the subject of nitrification. He has now given us the result of his studies on the above topic. In isolating these organisms he used what is by him termed the "elective" method of isolation. In this special case a culture medium was employed that was free from all combined nitrogen. It was made up as follows:

Distilled water, 1000cc; 20–40 gr. dextrose; 1 gr. potassium phosphate; 0.5 gr. magnesium sulphate; 0.01 0.02 gr, potassium chlorate, sulphate of iron, sulphate of manganese. This culture medium was then inoculated with garden earth. Most of the cultures soon showed evidence of butyric acid fermentation. Gas bubbles appearing in the immediate vicinity small masses floating in the medium. These masses somewhat resembled Kephir grains. This fermentation continued till all of the sugar was used up. After this fermentation, mould developed on these white grain-like masses, followed by algae. It appears that this medium at first wholly unsuited for higher plants because of the absence of nitrogen was made sutiable when appropriation of nitrogen by bacteria had taken place. The Kephir like masses consisted of a species of Clostridium to which he has given the name of C. pasteurianum, and two kinds of bacteria forming threads. The interesting details cannot be given here. Suffice it to say that this Clostridium is capable of obtaining nitrogen from the atmosphere, which is found in the medium in part as soluble inorganic nitrogen, but mostly as insoluble organic

combined nitrogen. (Archives des Sciences biologiques T
III. St. Petersburg, 1895, No. Bott. Centralbl. LXV, 277.)

MEDICAL MICROSCOPY.

Diarrhoea in Children and Milk.—It is well-known that
milk may give rise to intestinal disorders traced back to
the poisonous products produced by micro-organisms.
Dr. K. Alt indicates in a paper in Deutsch. Med. Noch-
euschr, 1896, No.5, that all troubles of this kind need not
necessarily be referred back to micro-organisms, but in
some cases the food consumed by cattle may be responsi-
ble for some of this poisoning. In the cases referred to
clover was thought to have caused the trouble. All pre-
cautions for sterilization seem not to have been taken into
consideration. Dr. Alt's conclusions are not warranted.

Tsetse Fly Disease or Nagana in Zululand. Dr. Bruce
claims to have traced the connection of this disease and
larger domestic animals to one of the Flagellatis (Trypan-
osoma evansi) which is carried over by Tsetse fly. It was
shown that the fly was not poisonous, but that when the
fly was allowed to take the blood of a diseased dog it could
carry the disease to another animal, dog, horse, or bovine.
(Centralbl. Bakt. Parasitenk. xix; Abth. I. 955.)

NEW PUBLICATIONS.

Medical Botany. Moquin-Tandon has published an
elementary treatise of 543 pages on this topic which con-
tains numerous figures of medical plants some excellent,
others rather poorly executed. The part dealing with
phaenogams is good but the part dealing with cryptogams
is not up with the times, some rather remarkable state-
ments being made. Just two pages are devoted to bacteria
Leptothrix fuccales and Merismopidia (Sarcina ventriculi).
His information concerning these is somewhat ancient.
Reference is made to this part of the work because it is a
sample of what one finds too frequently in so called scien-
tific publications.

EVOLUTION OF THE MICROSCOPE.
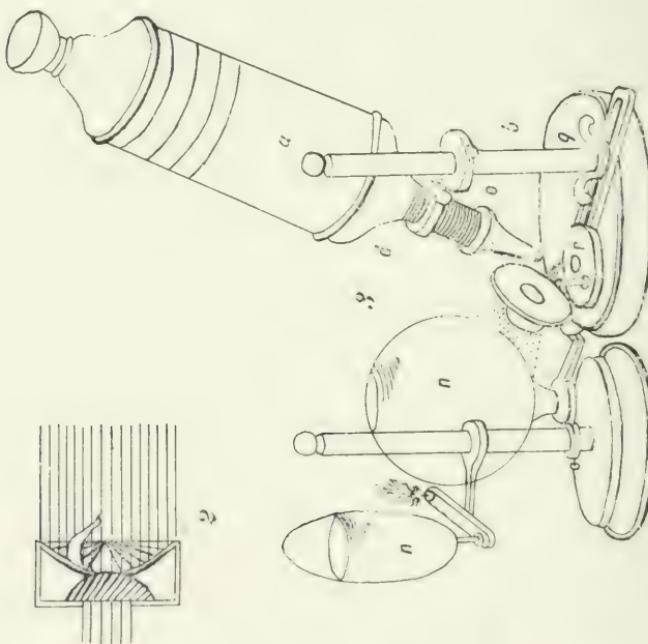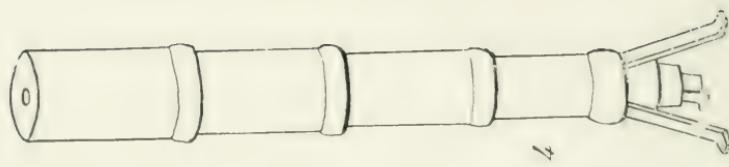
On the Evolution of the Microscope.

BY EDWARD M. NELSON,

LONDON.

WITH FRONTISPIECE.

One of the means of guidance for the future is a study
of the errors of the past. The end will be best served
by (*a*) a through investigation of a good type of instru-
ment designed at some period subsequent to the intro-
duction of achromatism, tracing the development of its
various parts from the earliest times. (*b*) A study of
modern instruments, showing wherein and why they
either follow or depart from the selected type. (*c*) The
collation of other material bearing on the development
of modern microscopes though not falling within the
limits of *a* and *b*.

The first step, then, is the choice of a type. (1) It
must be that towards which the modern microscope is
tending. (2) It must be a permanent form.

There is only one microscope in which both these
necessary conditions are to be found, and that is Powell's
No. 1, for it requires the slightest observation to per-
ceive (1) that the best modern microscopes are more and
more conforming to that type, and (2) that it has remain-
ed in its present form for upwards of twenty years.

Our first duty, then, is to describe all the causes accu-
mulated since the invention of the microscope, that have

influenced the design of Powell's No. 1. We say probably, because it is possible that Powell's No. 1, or any other form of microscope or apparatus, might have been designed by an inventor wholly unacquainted with any preceding form, though in the absence of any evidence to the contrary such a hypothesis would be highly improbable.

Those parts of this paper which treat of old microscopes are not intended to be a history of the microscopes; many interesting old forms will not even be mentioned. For the most part attention will be drawn to only those instruments that have been rungs in the ladder of evolution.

To begin, then, neither the name of the inventor nor the date of the first compound microscope has been with certainty determined. There is an extensive literature on the subject, and the conclusion arrived at is that the first microscope was probably made by Jansen, a spectacle maker, of Middelburg, in Holland, about the year 1660. An old microscope, supposed to be a Jansen, was exhibited at the loan collection of scientific instruments at South Kensington in 1876 (catalogue No. 3,510), the date of it given in the catalogue being 1590. This instrument had neither stand, object-holder, nor stage; the only mechanical movement with which it was furnished was a draw tube for separating the two convex lenses which formed the optical part of the instrument (Fig. 1).

The next step is to be found in a drawing of a simple microscope by Descartes in his "Dioptrique" in 1637. This shows a plano convex lens placed at the vertex of a concave mirror; in short it is an instrument now known as a Lieberkuhn. It is curious to note that while Descartes is very particular about the parabolic curves of his mirrors and the hyperbolic curves of his lenses the figures show the lenses turned the wrong way, which would

cause the spherical aberration to be increased four-fold.
Now as the difference between the aberrations arising
from the spherical and hyperbolic curves is for the pur-
poses under consideration insignificant, the above is a re-
markable instance of straining out a gnat and swallow-
ing a camel (Fig. 2).

The next important step is the application of a field
lens to the eye-piece by Monconys and Hooke. Mon-
conys' microscope was made in 1660, an account of it
being published in 1665. The application of a field lens
was also claimed by Hooke, who in 1665 published an
account of his microscope. Hooke's microscope is a
very important one, for in it we find several new feat-
ures, such as the inclination of the body, a screw focus-
sing adjustment, a movable object-holder, and an entirely
novel illuminating apparatus. In Fig. 3 we see a heavy
circular foot, p, with an upright post, b, fixed excentri-
cally to it. The limb which holds the body of the micro-
scope is attached to the post by a sliding ring, o, and
screw clamp. The limb is also jointed by a ball and
socket. At the other end of the limb is a ring, d, into
which the body screws with a coarse thread. This forms
the fine adjustment. The body, a, was fitted with four
draw tubes. This form of mounting for the body of a
microscope I call the "telescope mount," for the micro-
scope is pointed at the object precisely in the same man-
ner as a telescope would be. There is an ingenious
object-holder, r, consisting of a spike capable of rotation,
held by a short pillar attached excentrically to a rotating
disc. This disc is held in position by a link and butter-
fly nut, q; obviously, therefore, the object can be placed
in any desired position by these combined movements.

The lamp also was attached to a separate upright sup-
port by a ring and screw nut, very much in the same
way as it is fixed at the present time. There was an
rengaver's globe, n, filled with water for a primary con-

densing bull's eye, and a plano-convex lens, turned in its
proper position, *t*, as a secondary condensing lens was
fitted to a double-jointed arm. The illuminating appar-
atus was therefore suitable for opaque objects, and must
be regarded as being very complete and efficient in its
day.

Fig. 4 shows Divini's microscope (1667). The interest
in this instrument is not in the mount, which is of the
crudest form, but in the optical part, for in place of the
biconvex eye lens two plano-convex lenses, with their
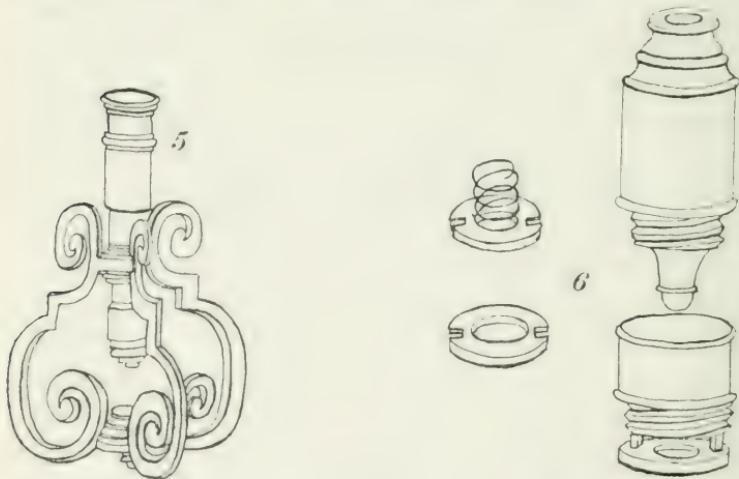
convex surfaces in contact, were used. This plan would
halve the amount of the spherical aberration.

Fig. 5 exhibits an improvement on the preceding form,
by Chérubin d'Orléans (1671). The body was more rig-
idly mounted by the enlargement of the tripod foot. A
screw movement was fitted to the stage for focussing.
In the optical part there is an erector. Chérubin
d'Orléans was the first to apply an erector to his monoc-
ular microscope, and he was also the first to construct a
binocular microscope. The binocular instrument would,
according to the drawing, have given a pseudostereo-
scopic image.

In 1672 Sir Isaac Newton suggested a reflecting microscope of the form of a Herschelian telescope. It probably was never made.

Leeuwenhoek's microscopes, constructed in 1673, are remarkable more on account of the man who used them than for their design, which was crude in the extreme. It is indeed difficult to understand how the discoveries he made could have been carried out with such rude apparatus.

In 1687 we find a microscope by Grindl very similar to Fig. 5. The optical part, however, consisted of three pairs of plano-convex lenses.

In 1691 several new features appear. Fig. 6 shows a screw-barrel compound microscope by Bonanni. The slider placed between two plates pressed together by a spiral spring, was made to approach or recede from the objective by a screw. This simple arrangement, known as the "screw barrel," played an important part in the history of the microscope for upwards of 100 years.

To Bonanni we are also indebted for a horizontal microscope in 1691 (Fig. 7). This instrument is noteworthy, first for the double support to the body. A glance at Hooke's (Fig. 3) will convince anyone how rickety the body must have been when only held by its focussing screw, so here we have a decided improvement. Secondly, we have a rack, i, and pinion, h, coarse adjustment, in addition to the usual screw fine adjustment, m, of that period. There is also an improvement in the stage, and the last, and perhaps the most important novelty, is the compound substage condenser, p, q. Hooke's illuminating apparatus was, as we have seen, more suitable for opaque objects; this, on the other hand, is more adapted for the illumination of transparent objects. We now come to an excellent simple microscope by Hartsoeker, in 1694 (Fig. 8). It will be observed that the Bonanni screw-barrel focussing arrangement, c, d, is

maintained. The novelty, however, consists in the sub-stage condensing lens, *e*, which can be focussed on the object by screwing, *f*, into the screw focussing tube. The important point in this arrangement is that the focus of the condenser is not disturbed while the object is being focussed to or from the magnifying lens. To Hartsoeker we are also indebted for a compressor.

Wilson's screw-barrel, of 1702, then known as the pocket microscope, was a popular form of simple micro-scope in the 18th century; it was very similar to Hart-

soeker's, the main difference being that the substage condensing lens had no separate focussing adjustment. Culpeper subsequently mounted these microscopes on a pillar rising from a flat folding tripod foot, a mirror and condensing lens being attached; he also added a com-pound body to them. Later, in 1742, the Wilson screw barrel was mounted on a brass scroll fixed to a circular wooden foot, to which was attached a concave mirror. In this same year it is also stated that two diaphragms were supplied with the ordinary hand Wilson screw-barrel simple microscope, to fit in a cell close to the sub-

stage condenser, to reduce its aperture when high powers
were used. This is the earliest notice of diaphragms for
regulating the illumination.
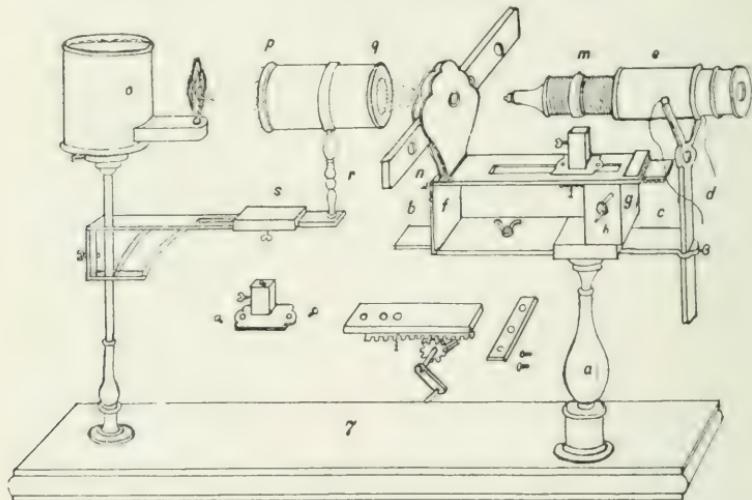
In the year, 1702, we find a crude form of simple
microscope by Mussenbroek. The only point of interest
it possesses is to be found in a sector of graduated dia-
phragm holes. The purpose of these diaphragms was for
diminishing the spherical aberration by cutting down the
apertures of the observing lens and not for regulating the

Top of Fig. 9
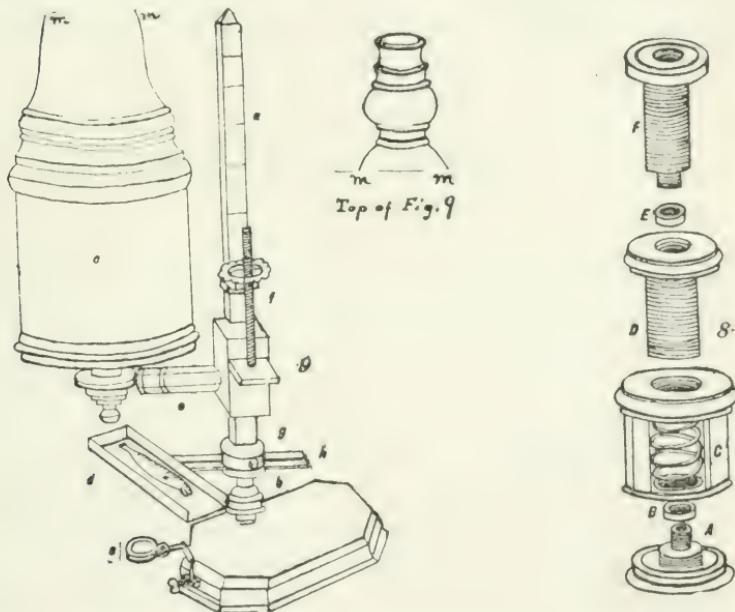
illumination. The next model, that of John Marshall,
1704, takes us on several steps in the evolution of the
microscope (Fig. 9). Here we first meet with the box-foot,
a distinctive feature which lasted for nearly 130 years.
The coarse adjustment is effected by a collar and jamb-
screw sliding on a square bar, the fine adjustment by a
direct acting screw, *f.* It is hardly correct to speak of
the sliding arrangement as a coarse adjustment because
the post, *a*, was marked with numbers corresponding

with similar numbers marked on the objectives ; the body
remained clamped at the given mark until the objective
was changed, all the necessary focussing being performed
by means of the direct acting screw.   The great advance
made in this model consists in the pivoting of the lower
end of the bar, *a*, on a ball and socket joint, *b*.   As the
stage, *d*, is also fixed to this bar it is obvious that when
the instrument is inclined the stage is also inclined with
it.   This feature is totally distinct from the " telescope
mount," and is one specially important in the evolution
of the microscope.—Queket Club.

Examination of Water.

By GEO. C. WHIPPLE,

NEWTON CENTRE, MASS.

The microscopical examination of water is becoming
every year a matter of greater interest, and the study of
the minute aquatic plants and animals is more and more
attracting the attention of scientists.   These organisms
are interesting for several reasons and, besides recogniz-
ing their importance in the domain of pure science, we
are beginning to appreciate the great part that they play
in nature and their effect, direct and indirect, upon the
human being.   Their presence in surface waters is often
the cause of much harm when the water is used for pur-
poses of domestic supply ; scores of instances may be
mentioned where they have rendered the water entirely
unfit for use.   On the other hand, their presence in ponds
and streams is of importance to the fish-culturist because
they form the fundamental source of the food supply of
fishes ; this is probably true both of salt and fresh water.
   Because of the connection between the number of micro-
scopical organisms in a cubic centimeter of water and the
price of fish in our markets, the study of the 'plankton,'
i. e., the floating micro-organisms, is being emphasized

on both sides of the Atlantic. Observers are beginning to trace the connection between the presence of microscopical organisms and the abundance of fish in our lakes and valuable comparisons have been made between the stomach and intestinal contents of fishes and the organisms found in the water where the catches were made. This work is of very great importance and should be vigorously pursued by our fish commissions. To be of the greatest value it should extend well over the country and include lakes and ponds sufficiently different in character to enable one to determine the laws governing the nature and distribution of the plankton in various climates and under various conditions. The study ought not to be carried on spasmodically, as, for instance, during the short vacation of some college professor who generously gives his time and talents to the cause, but should be undertaken seriously and continued throughout the whole year. Only in this way can we obtain the data necessary for a complete understanding of the subject.

Since water-works managers are equally interested in the microscopical organisms found in surface waters, and up to the present time have been responsible for most of the work done upon the subject, it might be possible for fish commissions, boards of health, water-works superintendents, and others interested, to work together according to a definite concerted plan, sending their results to some central commission or committee for comparison and study. Such an extended biological study taken in connection with meteorological records and observations upon temperature, transparency, etc., of the water would be of very great value. And it would seem that we have little excuse for neglecting to cultivate this fruitful field of research. Vast numbers of microscopical examinations are now being made. During the past eight years more than 40,000 have been made in Massachusetts alone, and the rapid growth of the new science of sanitary

biology is developing numbers of well-trained observers wide awake to the value of these problems and well able to undertake the work.   What is needed is cooperation.

Various methods have been employed from time to time for determining the character and amount of microscopic life in water.   Those interested in the subject from the piscatorial standpoint have usually employed some sort of net for straining the organisms from the water and concentrating them for the microscope.   One of the best devices of this kind is that devised by Professor Reighard and used with good results for studying the plankton in Lake Michigan.   It consists of a conical net of fine bolting cloth, at the small end of which there is a 'bucket,' made by covering a metal framework with some of the same bolting cloth.   The apparatus is hauled through the water, filtering a column of water whose cross section is the same as the circular mouth of the net and whose length is equal to the distance through which the net is hauled.   The organisms are caught by the fine bolting cloth and are ultimately washed into the bucket.   The collected material is then removed by an ingenious arrangement, measured and sent to the laboratory for microscopical examination.   By this method one is enabled to get a good idea of the total amount of suspended matter in the water, but it can hardly be called an accurate method of obtaining the number of living organisms present, as the net sweeps in amorphous matter as well as organisms and some of the smaller forms undoubtedly escape through the bolting cloth.   Moreover, the amount of water actually filtered cannot be told with a great degree of accuracy.   Nevertheless, the method is one of value, particularly for securing the larger and rarer forms of rotifers, crustacea, etc.

Sanitarians who have studied the microscopical organisms in water supplies have usually employed very different methods from the above, partly because they have

been interested more especially in the smaller forms, but chiefly because their operations have been confined to the small quantities of water sent to the laboratories for analysis. During the last decade the old methods of sediment examination have given way to the filtration methods. The Sedgwick-Rafter method, which is most used at the present time in laboratories of water analysis, is carried on as follows :

A portion of the water to be examined is measured out in a graduate and filtered through a thin layer of quartz sand placed at the bottom of a glass funnel upon a perforatedrubber stopper, the hole in which is capped with a disc of bolting cloth. When the water has filtered the organisms will be found upon the sand while the filtered water will be free from them. The rubber stopper is then removed and the sand washed into a test tube, with a measured quantity of distilled water delivered from a pipette. Usually 250 or 500 c. c. of the sample are filtered and the sand washed with 5 c. c. The test tube is then thoroughly shaken and the water decanted into a second tube; the organisms being lighter than the sand, will pass off with the water, leaving the sand clean upon the walls of the first tube. In this way the organisms are concentrated 50 or 100 times. One c. c. of this concentrated fluid is then transferred to a counting cell, which just holds it and which has a superficial area of 1,000 sq. mm. After putting a thin glass cover-slip over this cell it is transferred to the stage of the microscope for examination. The eye-piece of the microscope is fitted with a micrometer in the shape of a ruled square of such a size as to cover one square mm. on the stage, i. e. one thousandth of the entire area of the cell. The organisms observed within the limits of the ruled square are then counted and the cell moved until another portion comes into view, when another count is made. Thus 10 or 20 squares are counted and the number of organisms

present in the sample can then be calculated very easily.

This process has many things to be said in its favor, and it is undoubtedly the best all-around method for the study of the plankton. The apparatus required is simple, inexpensive and not liable to get out of order. The process is neither long nor difficult, and if care and cleanliness are observed in the manipulation very accurate results may be obtained. Ordinarily the quantity of water operated upon is small, but there is no reason why large filters may not be used. The writer has frequently used a funnel having a neck one inch in diameter, filtering from 1,000 to 10,000 c. c. This, when used with an aspirator to hasten the filtration, has given excellent satisfaction. The chief objection to the Sedgwick-Rafter method is that delicate organisms are liable to be crushed upon the sand, and this danger is naturally somewhat greater when this aspirator is used. It is probably no greater, however, than in Reighard's net.

Recently a new apparatus has been devised for the study of the microscopical organisms, known as the planktonikrit. This is a modification of the centrifugal machine and depends upon the fact that the specific gravity of the organisms is different from that of water. It has the advantage of avoiding, to a certain degree, the crushing of the delicate infusoria, but it is somewhat inaccurate in the case of some of the lighter organisms; furthermore, it operates upon very small quantities of water.

In a complete study of the microscopical organisms, such as might be undertaken on our great lakes, for example, it would be advisable to use all three methods adopting the Sedgwick-Rafter method for general quantitative work, but using the net and centrifugal apparatus for determining the rare and delicate organisms.

As there are many lovers of the microscope who are interested in studying aquatic life, and as there are many

others connected with water-works to whom the study
of algæ and infusoria would be of much value, the writer
has tried to reduce the Sedgwick-Rafter method to its
simplest possible elements in order that it may be more
generally used.   Furthermore, it is often necessary for
the sanitary biologist to be provided with a portable out-
fit for work in the field.   There are many fragile organ-

isms which will not bear transportation to the laboratory.
Uroglena, for example, a very important and troublesome
organism found in water supplies, goes to pieces com-
pletely when kept for a short time in a stoppered bottle.
It is, therefore, necessary to make the examination of
water immediately after the collection of the sample.
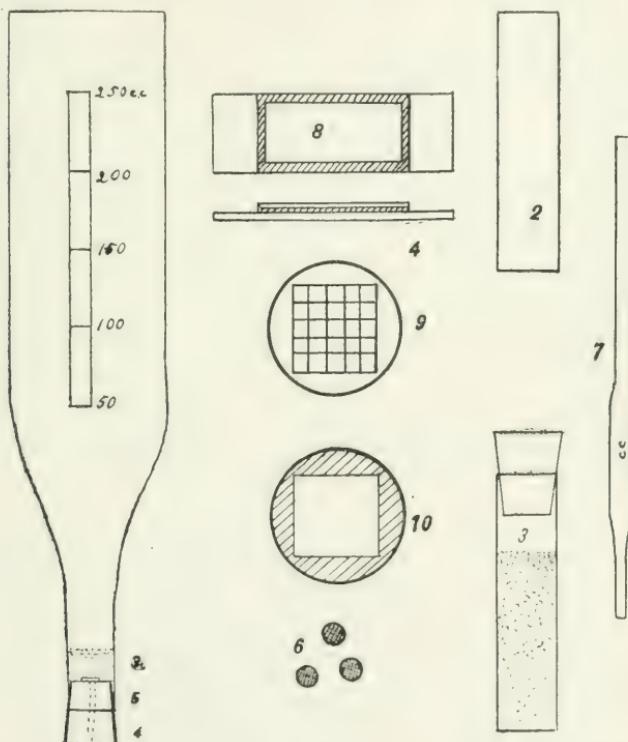
The chief modification of the method for field work

consists in the use of a cylindrical glass funnel (fig. 1) similar to the one designed by Mr. D. D. Jackson for the Massachusetts State Board of Health, but different from it in having a capacity of 250 instead of 500 c. c. and in having graduations marked upon the sides. This funnel may be conveniently carried and its graduation renders the use of a second measuring glass unnecessary. When in use it may be supported on a wire frame, which any ingenious person can make. In place of the test-tube it has been found convenient to use tube vials (fig. 2) having square ends. These require no racks and are not easily tipped over. The pipette for washing the sand might be dispensed with if one of the tube vials was graduated, but as much depends upon accuracy in concentrating the sample it is best to use a short pipette (fig. 7). The sand (fig. 3) used in the filter should be perfectly clean and of such size that its grains will pass through a sieve having 60 meshes to the inch, but not through one having 100 meshes. Crushed quartz makes the best filtering material and should be used when obtainable. The discs of bolting cloth (fig. 6) may be easily cut out with a wad cutter. The filtered water may be used for concentrating the organisms, or it is possible to employ preservative fluids in case the microscopical examination must be deferred or it is desired to keep the specimens. The cell (fig. 8) for holding the concentrated fluid may be made by cementing a brass rim to an ordinary glass slip. It should be 50 mm. long, 20 wide and 1 mm. deep, thus holding just 1 c. c. and having a superficial area of 1,000 sq. mm.

A very simple microscope will answer for this work. A large stand is too valuable and too heavy for the rough usage in the field, and a cheap, light stand with a $\frac{1}{2}$ inch or $\frac{2}{3}$ inch objective and a No. 3 ocular will answer equally well. The ocular must be provided with a micrometer, so that the observer may count the number of organisms

in one cu. mm. of the cell. A disc of glass ruled as in fig. 9 is the best form of micrometer, but a piece of thin metal with a square cut out, as shown in fig. 10, may be substituted. In either case the square must be of such a size that it covers one sq. mm. on the stage with a given combination of objective and ocular, and a certain tube length to be found by comparison with a stage micrometer. It is an advantage to have at hand higher powers for a more thorough study of the organisms met with, but for ordinary work the powers suggested are sufficient.

All this apparatus, together with bottles for collection and note book for records may be carried in a grip sack, and this will be found generally the most convenient way. It is possible, however, to make a neat box, with compartments for holding the microscope, funnels, tube, vials, etc., and I respectfully submit this to manufacturers of microscopical supplies.—Science.

Astronomical Photography with Photomicrographic Apparatus.

A. CLIFFORD MERCER, M. D.

SYRACUSE, N. Y.

On the twentieth of October, 1892, occurred a partial eclipse of the sun, and my heliostat was placed on a shelf outside a south window. Within the room was a portrait lens of eight inches focus and a microscope in the small axial line. The substage condenser was removed and a camera connected with the eye end of the microscope tube. Such sunlight as fell on the mirror of the heliostat was reflected through the portrait lens The portrait lens projected an image of the clouded sun's disc, about one-twelfth of an inch in diameter, in the plane usually occupied by an object on the stage of the microscope. This tiny image was itself projected by

a microscope objective of an inch and a half focus to form
a second image, two inches and three-eighths in diam-
eter, on the ground-glass of the camera. The clouds
made sharp focusing impossible. Only an imperfect
focus was obtained. The clock of the heliostat kept the
image steadily on the ground glass.

During the eclipse sensitized plates were substituted
for the ground-glass. Exposures were made when the
clouds were thin enough to permit. Thus six negatives
were secured. The first print shows the moon's black
disc, advancing apparently from the north-east across
the sun's disc, while the second shows the moon's disc,
passing off to the west.

This is the first record of an attempt to use photomic-
rography astronomically. All of the necessary appa-
ratus could be easily packed in a trunk. If an unaided
telescope objective were used to project an image of the
size obtained, a focus of twenty-one feet would be re-
quired; and the lens would have a diameter of about six-
teen inches. Such an objective properly mounted would
result in an instrument nearly half as large as the great
Lick telescope, with its photographic objective. By
using a portrait lens having a focus of fifteen or sixteen
inches, a size commonly used for "cabinets" in photog-
raphers' studios, instead of the portrait lens, the appa-
ratus will produce a negative image equal in size to that
produced by the unaided Lick lens; or, leaving the por-
trait lens in place, the same result could be obtained by
substituting for the microscope objective of one inch and
a half focus, another of about double the power,—one of
three-quarters of an inch focus. The Lick instrument
has a tube about fifty feet long and forty-two inches in
diameter, while this apparatus has two tubes less than
one foot long and about one inch and six inches in
diameter respectively. To the smaller tube is attached
a camera with a bellows extending from one to six

feet. Stability and freedom from vibration are very easily obtained with the small and short apparatus The difference in cost is enormous. In several respects the photomicrographic arrangement has advantages over the great Lick photographic instrument.

If, however, we turn to the matters of light and separating power, the very great superiority of the Lick objective is seen. The results given in the following tabular comparison are only approximately accurate. The loss light suffers by absorption as it passes through glass and by reflection at incident surfaces, is not taken into account;—the Lick objective consisting of three thick lenses and the photomicrographic arrangement having more than twice as many, but comparatively very thin, lenses and the mirror's reflecting surface:

	Lick Objective.	Larger Portrait Lens.	Smaller Portrait Lens.
Diameter of objective................	33 in.	3.75 in.	2 in.
Focus of objective..........	550 in.	15 in.	8 in.
Focus divided by diameter......	16.66	4	4
Relative value of light in first image.........	1	16	16
Size of first image........	5.1 in	.1395 in.	.0744 in.
Total equivalent focus, 550 inches, divided by diameter......	16.66	147	275
Relative value of light in final image......	1	$\frac{1}{77}$	$\frac{1}{277}$
Time of exposure, eclipse of sun (about)	$\frac{1}{1600}$ sec.	$\frac{1}{20}$ sec.	$\frac{1}{5}$ sec.
Separating power......	1	$\frac{1}{8\,8}$	$\frac{1}{16.\,66}$

Other things being equal, separating power varies with the aperture or diameter of the objective. If the lick objective, having an aperture of thirty-three inches, could barely show a certain double star as two distinct stars, it would be impossible for any objective having an aperture of four or two inches to show such a double star as two distinct stars. A star apparently single when seen through any objective having an aperture of two

inches might be seen to consist of sixteen or seventeen stars in line, almost touching one another when seen through the Lick photographic objective. A star apparently single when seen through any objective, having an aperture of three inches and three-quarters might be seen to consist of eight or nine stars in line, almost touching one another, when seen through the Lick photographic objective. The power of resolving an apparent single star into two or more, or of showing the details of sun spots or other objects, is known as separating power. A superior correction of aberrations is now possible in lenses made of small discs of glass which are produced in great variety as to optical properties, a variety not yet realised, in large discs.—Tr. A. M. S.

Progress in Effects with the Roentgen X-Rays.

To see through a person in a metaphorical sense has been the wish of most people at some time or another, but it has now become a literal fact by means of the occult rays, popularly known as the X-rays (on account of their exact properties not being understood), discovered by Professor Roentgen of the University of Wurzburg. It seems inexplicable that with the art of photography, so highly developed as it has been for many years, and with the experiments that have been taking place in laboratories all over the world in radiant matter in vacuum tubes, that we should have had to wait for the year 1896 for this discovery to have been made practically available; it only leads us to reflect that " there are more things in heaven and earth than are dreamt of in our philosophy," and that there is yet room for fresh and startling inventions and discoveries.

The first announcement of Prof. Roentgen's discovery that rays from a Crooke's or Lennard's tube of high vacuum had a power of penetrating numerous substances,

such as wood, leather, flesh, etc., which hitherto had been classed as opaque, was received with incredulity, but the circumstantial description of the methods employed enabled persons possessing the requisite instruments to repeat the experiments and to confirm the report. Not the least important aspect of the discovery was, that it was likely to prove a valuable means of contributing to the relief of some of the ills to which flesh is heir, by exhibiting details of bony structure of the living subject, bone being opaque to these rays, while flesh is practically transparent.

Two special features are associated with these X-rays, (a) that the emulsion on an ordinary photographic dry plate is sensitive to them, and (b) that certain chemical salts become fluorescent, that is, appear aglow with light under their influence.

Let us examine these features in detail. Prof. Roentgen found that if a photographic dry plate were enclosed in a wooden box, and a coin were placed on the outside of the box with the vacuum tube above, on the tube being excited by means of an electric current the X-rays penetrated the wood, (which is practically transparent to them) but not the coin, with the result that the image of the coin appeared on the plate inside the box on its being developed. In like manner, if the hand were placed on the box, the bones being opaque to the rays were shadowed on the dry plate.

The title of photography as ordinarily understood was not applicable to these effects, and the name of radiography was, after considerable discussion, given to the process. It at once became apparent that a large field for investigation and experiment had been opened, and it was not long ere the London hospitals were employing the X-rays for the investigation of bone diseases and fractures, and for ascertaining the exact position of foreign bodies, such as bullets, shots, needles, etc., in the

flesh with the view to their easy and speediest removal.

We have already shown in this periodical the bones of the hand of an Egyptian Mummy, radiographed through the wrappings, flesh, etc., the structure being exhibited beautifully. Herewith is a radiograph of a fracture of

the Olecranon process of the elbow, and a radiograph of the human hand will appear as frontispiece next issue.

Great difficulty was experienced in the early days in penetrating deep structure; and radiographing ribs, vertebræ, etc., presented considerable difficulties, but as the

results of experiments, improvements were made in nearly all the apparatus that was necessary, and quite recently Dr. Macintyre of Glasgow, Scotland, has successfully radiographed a calculus of the kidney en situ which was subsequently found to have been precisely delineated on the operating table. The same gentleman has also successfully radiographed the ribs and vertebræ of adult men, obtaining at the same time faint outlines of important organs, particularly the heart, in one case of which an enlargement was distinctly portrayed, but we are to have further developments yet.

An interesting feature in connection with the Roentgen rays is its usefulness in detecting imitation gems both diamonds and rubies being transparent to the Roentgen rays, while imitations in glass or paste are opaque to them. Already a considerable use has been made of this aspect. The process is also exceedingly useful for examining the contents of postal packets, anything of a metallic nature being at once detected if contained in a wooden box. The only protection against such a revelation is of course to pack goods in a metal box through which the rays will not penetrate. It is rumoured that instruments are already in use in the General Post Office, London, for examing packets and the English War Department has invested in a considerable number of sets with a view to locating bullets on the battle field and so saving the painful and tedious operation of probing.

THE FLUORESCENT SCREEN :— It was remarked that under the influence of the X rays certain chemical salts have the power of becoming brilliantly illuminated and of rendering visible objects which are opaque to the rays that are interposed between the vacuum tube and the fluorescent screen. For instance, if the hand be placed between the fluorescent screen and the vacuum tube the bones will be distinctly shadowed on the screen while the flesh will be almost transparent, if the body be interposed

the ribs and vertebrae will be distinctly visible. Several materials have been suggested for the manufacture of these screens but probably the most successful has been Platino-cyanide of Potassium. This salt, however, varies very considerably in its fluorescent properties and quantities from the same manufacturer purchased at separate times do not yield uniform results. The method of preparation is as follows : The Platino-cyanide is ground as finely as possible with a pestle and mortar. It is then mixed with weak clear gum water and spread evenly upon a thin sheet of cardboard. One coat alone at a time should be given and allowed to dry; two or three coats are usually sufficient. Owing to the expense of the material and the chances of failure in preparing, it has usually been found more economical to purchase ready made screens. Calcium tungstate was the material suggested by Edison for these screens but it does not compare favorably with Platino-cyanide of Potassium.

A new screen has recently been placed on the market by Watson & Sons, London, which surpasses in brilliance others that have been so far made. The material is a secret preparation but with a good focus tube it enables the bones (ribs, vertebrae, etc.) of an adult person to be seen clearly.

APPARATUS :—At the outset extravagant rumors were set afloat as to the cost of the necessary instruments, but the outfit has now been reduced to a battery, an induction coil and a vacuum tube.

Additional but not absolutely necessary apparatus, would be a holder for the tube, and a fluorescent screen. The battery may consist of either Bunsen's or Grove's bells or a 4 cell accumulator giving 8 volts and a current of about 8 amperes.

THE COIL :— A Ruhmkorff Induction Coil giving a 3 inch spark only is sufficient for obtaining Radiographs of the arm, leg, etc. but if deeper structures are to be dealt with

it is well to have a coil giving a greater length of spark, say 6 inches. The tube is much more brilliantly illuminated with such a coil, exposure is shortened and deep structures more easily penetrated. There is another reason also why so large a coil as a 6 inch should be taken. With use the vacuum of a tube becomes higher and is consequently more difficult to excite. Warming with a spirit lamp will reduce the vacuum but it is not nearly so satisfactory as being able to excite the tube direct from the coil.

THE TUBE :—More failures in working have been due to defective tubes than to anything else, in fact a large majority of the tubes that have been sent out have been absolutely worthless. It is unwise to buy any tube without a guarantee of its suitability and perfection in working and where such a guarantee is obtained the price is usually somewhat high. Still it is better to pay a fair price for a good article than to have several unsatisfactory tubes at a low price.

As tubes are somewhat liable to damage it is well to be provided with two or three. No absolute statement can be made as to the length of life of a tube. The writer has one in use which has been constantly employed for the past three months and is as good as ever, while others have sometimes failed in some particular after a very short period of use. We have experimented with tubes by all makers and have spared no expense in having the latest patterns as they have been issued, but in our hands the focus tube as manufactured by W. Watson & Sons surpasses every other kind both for the fluorescent screen and for radiographic effects.

There is no doubt that the whole process is in its infancy and time alone will show in which direction further successful progress in the methods will be made. Supplementary apparatus will also appear to augment its usefulness.

EDITORIAL.

Laboratory.—The best equipped and most complete bacteriological laboratory on the Pacific coast is owned and conducted by Prof. S. M. Mouser, at 707 Bush street, San Francisco. Professor Mouser has devoted many years of his life to the study of this comparatively recent, but rapidly growing science.   He has secured all the latest instruments and scientific appliances, and is constantly in receipt of all the important pathogenic bacilli cultures for experimental, teaching and therapeutic purposes. It is gratifying to note that the Professor's labors are appreciated, notwithstanding that many of our ancient confreres are still scoffing at the science. Besides being Professor of Bacteriology and Pathology in the College of Physicians and Surgeons of San Francisco, Dr. Mouser daily conducts large private classes in bacteriology and pathology at his laboratory, as well as doing private analytical work for the profession on the coast.

The Danger from Bovine Tuberculosis.— Dr. W. L. West of Ellsworth, Me., has reported to Dr. G. H. Bailey that two children of a man named Luther Bridges have recently died of tuberculosis, due to drinking milk from a cow which was found, when killed, to be the subject of extensive tubercular disease, localized in the udder. Five of Bridges' nine children are suffering from pulmonary tuberculosis and several are now, according to the report, fatally ill.

MICROSCOPICAL APPARATUS.

Micrometer Rulings.—On May 21st, 1897, there was exhibited before the New York Microscopical Society a very simple piece of mechanism for producing fine rulings on glass. The inventions hitherto employed for this purpose have been elaborate and costly, while on this article from the labor of an ordinary machinist the cost was less than five dollars. To rule lines accurately up to fifty

thousand to the inch and more by such an appliance seems almost incredible.

The inventor, Rev. D. W. Smith, of Brooklyn, N. Y., having need of some work of this kind to assist him in certain experiments, with a few pieces of metal and glass evolved the machine referred to. He states that, beyond forty or fifty lines to the inch, the task of ruling lies more
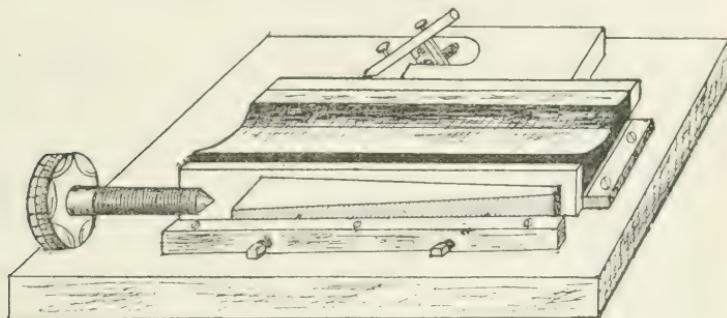
DESCRIPTION OF FIGURE.

A.—Micronometer screw operating upon the base of the movable wedge.

B.—Movable wedge, adjusted by set screws working in contact with strips of plate glass.

C.—Brass block, having only lateral movement caused by the thrust of the wedge

D.—Diamond carrier, easily adjusted to any position and weight necessary for any degree of cutting, and moved laterally by the brass block and longitudinally by hand.

E.—Graduated drum upon the micrometer screw.

F, F.—Iron base supporting the entire apparatus.

The following parts, for distinctness, are not represented in the figure A broad clamping nut supporting the micrometer screw; an index for the graduated drum; and the retaining springs holding the movable portions in contact.

in the proper selection of diamond points or crystals, necessary for lines of the required fineness, than in the accuracy of the machine.

The principle involved is that of a screw, operating upon a wedge of brass, moving the latter longitudinally on the supported bed. The screw contains sixty threads to the inch, which number is by no means an arbitrary one. For the wedge is capable of adjustment by means of set screws

which serve to correct its movements to correspond
with the inch or millimeter to be ruled. In this case one
revolution of the screw moves the wedge so that its lateral
displacement is equal to one one-thousandth of an inch.
This lateral displacement of the moving wedge operates
on a block of brass resting on three points projecting from
its base. By the side of this block of brass is operated
the diamond carrier. The points of contact for the entire
system of screw, wedge, block of brass and diamond car-
rier, operate upon pieces of plate glass—plate glass strips
where contact points move on wedge and block, and plate
glass bed resting on an iron base, which supports the
longitudinal and lateral movements of the block of brass
and the diamond carrier. This give a smooth and accu-
rate motion to all the working parts, which could be other-
wise obtained only by expensive and carefully polished
steel surfaces.

This is a general description of the first working model
so far as is known, using the principle of the wedge as a
means of adjustment and correction, and of imparting the
motion of a decreasing gear from the screw which is nec-
essary for such work. A considerable motion of the
screw is thus given for minute divisions, thereby ensur-
ing uniform and accurate rulings.

The device for carrying the diamond, as first used, was
a single carriage. moved back and forth by hand along
the glass bed plate, and held in its place to the brass
block by means of contact springs. Afterwards for con-
venience, a triple link carriage was made, that is, three
separate parts hung by three trunnion points of hardened
steel accurately turned. Though much more scientific.
and easier of use the results, up to thirty or forty
thousand lines, was hardly worth the trouble of its
construction, save the chance of any disturbance of the
diamond point by accidental handling of the diamond
during ruling.

With a little more trouble the entire arrangement
could be easily adjusted to become entirely automatic in
its movements, whereas in the present model the move-

ment of the screw and that of the diamond carrier requires separate and distinct operations. With the screw thus connected a motion is given to the diamond covering a space of about one-fifth of an inch in width. Thus a screw sixteen inches long would give movement enough to rule a spectrum band one inch square.

MICROSCOPICAL MANIPULATION.

Drinking Water.—Schumburg has thoroughly gone into all known methods of purifying drinking water, and finds that bromine is the only disinfectant which can be removed after serving its purpose, without spoiling the appearance and taste of the water. The quantity of bromine used is very small; 1 kilogramme is sufficient to sterilize 16,000 litres of water. The author uses the bromine in the following solution:—Water, 100; potassium bromide, 20; bromine, 20. 0-2 C.c. of this solution is sufficient to sterilize in five minutes 1 litre of water from the river Spree. The calcium salts or ammonia of very impure river or surface water use up some of the bromine before it has had time to develop its disinfectant properties. In such cases enough must be added to cause a slight yellow coloration of the water, which should last at least half a minute. The 0-2 C.c. of bromine solution may be removed by adding an equal quantity of 9 per cent ammonia.—*Pharm. Zeitg.*, xlii., 174.

BACTERIOLOGY.

Baldness.—Dr. Sabouraud, in the Annales de Dermatologie, firmly believes that the disease is contagious, and that barbers' instruments are the most common carriers of the contagion; but as customers come and go from one barber to another, it is difficult to trace each case to its source. Starting with the theory of the microbic origin of the disease, Sabouraud has worked out a strong chain of evidence in its support. He tells us that the typical hair of Alopecia areata is found at the edge of an advancing patch,

and is a stump of long hair that has remained in the scalp. It is club shaped, or like an interrogation point. Its diameter becomes less as we go towards the root, and its color is lost. These hairs are always a sign of an advancing patch, and are not found in old patches. The medullary (or pit) canal of these hairs is normal above, altered in the middle, and it is completely wanting at the root. The root is not bulbous and hollowed for the papilla, but in the form of a turnip. . . . Utricules that are full and closed are found among the sound hairs. They are filled with joined strata of epidermic cells, and contain in their centers, like a larva in a cocoon, compact clusters of microbes, a pure culture of the smallest bacillus known. . . . As it grows old it may be one quarter millimeter (0.01 inch) wide and one-half to one millimeter long, and comma shaped, or bent. The young bacilli are a little swollen in the center, and their ends are blunt. . . . Each utricule contains millions of them. . . . This bacillus is regarded as the most probable cause of the disease.—*Sci. Am.*

Leprosy.—Leprosy furnishes the best opportunity for studying a parasite of a bacterial nature. The relation of the cells can be plainly shown, since they do so little damage. Regarding the phagocyte theory: As Dr. Rosenstirn says, inert substances can be taken up by the leucocytes. It has been said that the bacteria that we stain are dead; that they have a keratin-like envelope capable of dying. In several forms of leprosy they are hard to find, especially in erythematous cases. The discovery of bacteria floating free in the blood is not new. It is remarkable that they can float through the kidneys and do no damage, but they seem to take up in certain tissues; for instance, the eye-brows, and not the scalp.

It is the concensus of opinion that a leucocyte cannot pick up a bacterium unless it be dead; it being a process of digestion. The action is such that if the bacterium remained there long alive, either one or the other must die; they are so antagonistic to one another. There is no reason why the leucocyte cannot take up 30 or 40 bacilli.

Caseous Rhinitis.— During the last year or two Prof. Guarnaccia (Archivii Italiani di Laringologia, No. 4, 1896) has made bacteriological researches upon caseous rhinitis. These studies refer to a case observed by Massei in his clinic. Guarnaccia has demonstrated that the micro-organism found in rhinitis caseosa, which was so differently understood by Perier, Sabrazes, etc., is streptothrix alba, or Foersterii, studied by Rossi-Doria, Cohn, and Gasperini. The author was able to cultivate it in agar gelatin, bouillon, blood-serum, potatoes, and milk. Inoculations in animals were not successful. It is perfectly correct, in his opinion, to assume that the considerable amount of caseous matter is formed by the growth of the streptothrix, as is the case in muguet.—Universal Medical Journal.

Tuberculosis in Goats.—From the following it will be seen that the hitherto accepted theory that goats are immune to tuberculosis is not altogether correct. Bulling (Indian Medical Record) records a case of pulmonary tuberculosis in a goat. Both lungs were adherent, and large and small tuberculous foci were present. The author concludes that it would be well to examine into the possibility of the transmission of tuberculosis through the agency of goats, and to consume their milk only after boiling, or after the goat has been shown to be free from tuberculosis by the absence of reaction after the injection of tuberculin.

MICROSCOPICAL NOTES.

Circulation of Blood.—Most books recommend the use of a frog's foot for this purpose and give directions for accomplishing the purpose. The object may easily be attained with a small tadpole, lizzard, and with many of the larger water larvae. The latter will show the circulation all through the body. With the lizzard and tadpole, it may best be seen in the thin membranes of their tails. All that is necessary is to place the animal in a glass slip with a shallow cell and cover it.

MICROSCOPICAL SOCIETIES.

American Microscopical Society.

The 1897 Meeting.—It was held at Toledo but owing to the attraction of the A. A. A. S., and the British Association at Toronto and the lack of preparation for the meeting it proved almost an entire failure. The Toledo papers paid almost no attention to the matter and sent no reporters to the meeting. From two short notices in the Toledo Blade, however, we are able to glean the following:

Thursday August 5.—Meeting opened in the High School building with an address by the President, E. W. Claypole, upon "Microscopic Light in Geological Darkness." Only a small number of persons were present they being mostly Toledo microscopists and their friends. An informal talk or "reception" followed the address.

Friday Aug. 6.—The meeting for business commenced at 9:30 a. m., (with a dozen present), and after unimportant matters had been discussed, Prof. D. S. Kellicott of Columbus, Ohio, spoke on the "Capture and Study of Rotifers." Miss Edith J. Claypole, a daughter of the President read a technical paper on "Comparative Structure of the Digestive Tract." Francis L. Rice, of Steelton, Pa., had expected to present a "microscopic examination of steel."

Friday P. M.—No meeting. The visitors were escorted about town by citizens to see "various points of pleasure and interest."

Friday Evening.—Soiree. All the available microscopes in Toledo were brought to the Library Building and the miscellaneous public were shown the usual wonders of the invisible realm. "Every body who has any interest in these matters should avail themselves of the opportunity," was the invitation to the public. "The public except small children, is cordially invited." "There were nearly 100 instruments of all sizes the lens of some of them being extremely powerful."

Saturday Aug. 7.—The sessions closed with the election

of officers and the reading of two papers. No new persons being available for president it was thought wise to elect one of the early presidents again.

The list for 1897–8 is as follows :

> President, D. S. Kellicott.
> Vice–President, Mrs. S. H. Gage.
> "   V. A. Moore.
> Secretary, Dr. W. C. Krauss.
> Treasurer, Magnus Pflaum.
> Committee, Dr. D. E. Haag, Edith Claypole, and John M. Berry.

The Secretary and Treasurer are hold-overs.

A paper was then read by Agnes M. Claypole on "Forms of Cleavage in eggs of certain Arthropods." The other paper of like technical character was by John M. Berry of Peterboro, N. Y., on "Phagocytic Action of Leucocytes in Amphibians and Mammals.

The society then adjourned to meet at such time and place as the committee may hereafter agree upon. It seems that no invitations were received by the society for next year and no exhibits, working sessions, excursions or banquets were connected with the meeting this year. The Blade says : "While the attendance was not so large as had been anticipated the interest of those present was none the less apparent." It also announces that one enthusiast, J. C. Smith, had come all the way ·from New Orleans, to attend and that there were two or three people from Fort Wayne, Ind.

Certainly the thanks of Toledo are due to the Professor Claypole and his two daughters, without whose presence the meeting would have lost largely and whose papers constitute in bulk three quarters of all the mental pabulum furnished the visitors. The Blade properly acknowledges this by saying : "Perhaps the best known microscopists in this section are Prof. Claypole and his two daughters, who are always among the leaders in any event that tends to create microscopic interest."

Our society is indebted to Dr. D. E. Haag for securing the school room for its use and for working up the exhibi-

tion of objects at the Soiree.   It appears to have shown its
thankfulness by electing him a member of the Executive
Committee, while the other two members earned their
places by reading papers.

If the Secretary will confine the Proceedings to the act-
ual occurences at Toledo, we are of the opinion that his
fond hope of having them out by Christmas ought to be
realizable.   But if he waits for absent members to write
some papers with which to eek out a report, he will per-
haps be delayed till next spring or summer.

NEW PUBLICATIONS.

Elementary Zoology and Laboratory Guide.—By H.
E. Chapin and L. J. Rettger., Chicago, 1897, 212 pp., 145
figs. 8 vo.

In the preface, our authors significantly remark : " A
teacher who expects to do no more than read the following
pages is begged to close the book at once and turn his at-
tention to more profitable things. "A teacher who would
merely assign three pages in advance each day had better
exchange the book for an almanac or a treatise on
Chinese."

This book then is not to be memorized and recited.   You
are to go into the laboratory and museum and study ob-
jects of Natural History.   Perchance this book will help
you—that all depends on you.   The book is all right : are
you ?

Chapters are devoted to Protozoa, Porifera, Cœlenterata,
Echinodermata, Vermes, Molluscoidea, Mollusca, Arthro-
poda, Vertebrata, and Laboratory methods. Embryol-
ogy and minute structure are not much touched upon, the
scope of the book being microscopic largely.   We heartily
commend it to the notice of all teachers.

A few pages on the microscope contain the rudiments of
knowledge needed by the beginner.   Hardening and
mounting media are described briefly, so is embedding,
section cutting, etc.
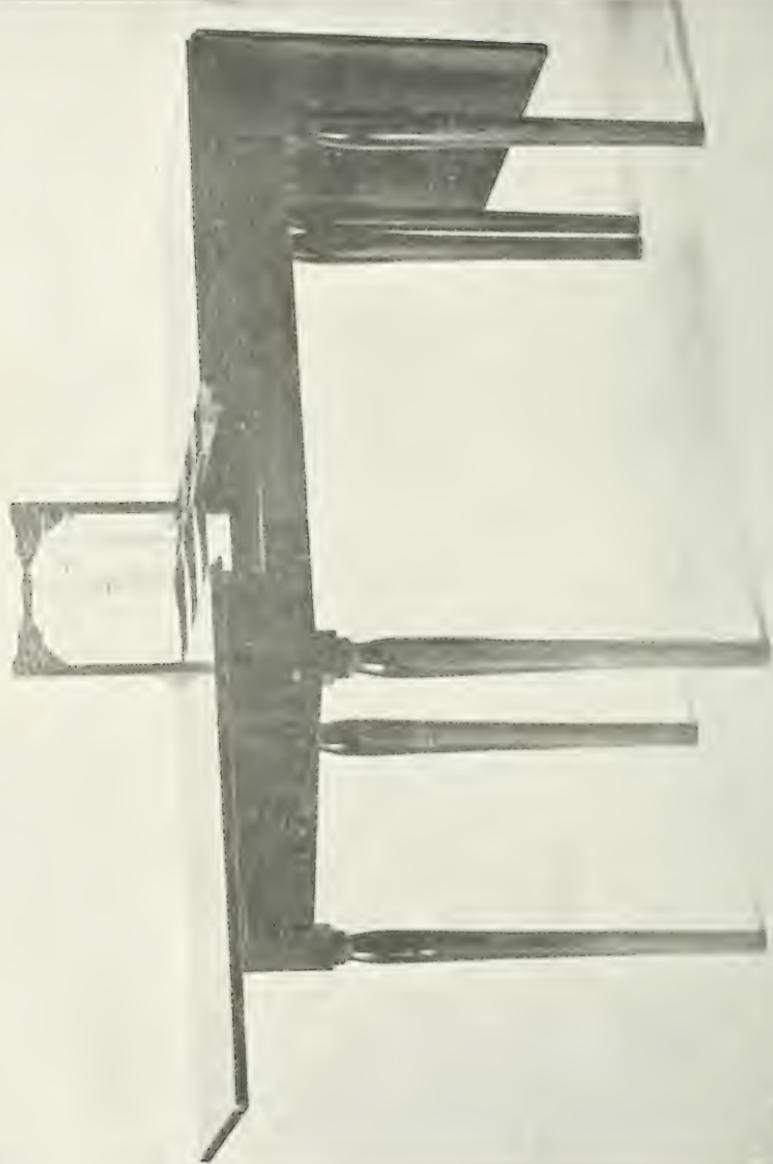
THE FLUOROMETER.

Parasitic Leaf-Fungi.

By Rev. ALEX. S. WILSON.

About the time when the blackberries are ripe, after a short search one can generally find a bush the leaves of which have a paler appearance than ordinary ; closer inspection shows the under surfaces of the leaves flecked here and there as if with specks of soot. With the aid of a pocket lens each speck is seen to consist of tufts of little club-shaped bodies, and if we scrape some off, mount them on a slide, and place it under the microscope, we see that they are cylindrical cells, each made up of from three to eight joints, and supported by a short stalk. Their form is so characteristic that, once seen, there is no difficulty in recognizing it again. These are the telutospores of the bramble brand (Phragmidium violaceum), a parasitic fungus belonging to the order Æcidiomycetes (or Uredines), all of which inhabit living plants.

The leaves of various species of mint are in autumn often dotted over in like manner with dark-colored spots, due in this case to the telutospores of Puccinia menthæ, each composed of two joints of hemispherical form. By this two-celled character the Puccinia genus is distinguished from Phragmidium, which has telutospores usually consisting of more than three joints. On the meadow-sweet a brand, Triphragmidium ulmariæ, occurs, having three-celled telutospores ; those of the brands

which affect the bean, pea, clover, and lady's-mantle, species of Uromyces, are uni-cellular. Gymnosporangium (Rostelia) growing on junipers has them two-celled, closely packed, and embedded in gelatinous substance : they are prismatic, and form a compact layer in Melamspora infesting the leaves of the willow and sunspurge ; and the species of Colesporium living on the colt's-foot and eye-bright have four-celled telutospores united to form a compact, waxy stratum, surrounded by a gelatinous mass. The characters presented by their telutospores thus form the basis of the classification usually followed in this group of fungi, the spores of which, indeed, constitute the principal feature.

Telutospores are resting or winter spores ; only in a few cases are they capable of immediate germination. The name derived from telos, "end," indicates that their production is regarded as completing the life cycle of the fungus. Unlike other spores, which on germination give rise to a branching mass of thread-like cells known as a mycelium, which is really the vegetative body of the fungus, a telutospore only developes a short filament or promycelium, on which arises small reproductive cells, the sporidia; the latter are able at once to germinate and form mycelia.

Minute yellow streaks may be observed during the latter half of the year on the leaves of all our common grasses, especially on the lower leaves, by anyone who will take the trouble to look for them. On examining these with the pocket lens they are found to be chinks in the epidermis of the leaf filled with orange-coloured dust. Under a microscope of low power, with direct light, a small piece of grass-blade so affected presents a charming appearance. The dust is seen to be composed of orange red globules, having a waxy lustre or bloom, reminding one of artificial fruits, and forming a splendid contrast to the bright green chlorophyll grains of the

leaf. With careful focussing under a higher power, minute projections studding the surface of the spores become visible, giving them a bristly appearance. These are the summer or uredospores of a parasitic fungus now designated *Puccinia rubigo vera*, one of the corn-rusts which occasionally inflict so much damage on cereal crops. *Puccinia graminis* injures the wheat; allied species occasion the orange and scarlet patches of rust seen on the rose, barren strawberry, eye-bright, cow-wheat, sow-thistle, groundsel, thistle, harebell, nightshade, dog's mercury, and many other native plants. The name uredospore (*uro*, "I burn") has reference to the conspicuous disfigurment and often burnt appearance of leaves attacked by these fungi. Unlike telutospores, the uredospore germinates at once if placed on a suitable host, and gives rise to a filament which penetrates the epidermis and developes into a mycelium, extending through the intercellular passages of the leaf. Uredospores commonly appear somewhat earlier in the season than telutospores, though the two often grow together.

On gooseberries our readers may sometimes have remarked a bright yellow spot about the size of a sixpence. Similar spots occur on the leaves of gooseberry and currant bushes. The lens shows that they consist of a number of small round openings full of orange powder; these are the cluster-cups and æcidiospores of *Æcidium grossulariæ*. An exceedingly common species, *Æ. compositarum*, is found on the lower surface of the colt's foot leaf, a plant abundant on every railway embankment. Plants may possess more than one species of parasite; on the colt's-foot there also occurs a species of Colesporium, and nearly a score of different fungi are stated to take up their quarters on the leaves of the nettle. Each species of æcidium confines itself, as a rule, however, to plants of a particular family, or even selects its hosts from a single species; thus the æcidia of the berberry,

hawthorn, honeysuckle, Scotch fir, mountain ash, ane-
mone, buttercup, nettle, primrose, violet, willow-herb,
bedstraw, dock, and many other plants are all different
and belong to distinct species. Seen with the lens the
cluster-cups present the appearance of a group of mina-
ture volcanoes. At first the æcidium fruit is a small
spherical body formed beneath the epidermis of the leaf
whereon it grows, which it ultimately ruptures; the æcid-
ium itself, when ripe, bursts, and the yellow spores are
discharged. The section of an æcidium shows a cup-like
cavity with spores arranged in vertical rows like
short strings of beads; they are developed by budding, and
become detached in succession. Externally the aecidium
is in most species invested by a membranous envelope,
the peridium, usually cup-shaped, but occasionally, as in
the cluster-cups of the pine, prolonged into a tube. The
peridium may open irregularly or split up in a definite
manner, giving its margin a toothed appearance. An
aecidiospore can germinate when sown on a suitable
host. The cluster-cups appear earlier in the season than
the uredo- or telutospores, and are very often associated
with smaller caps called spermogonia, which appear on
the upper surface of the leaf (fig. 5, a spm.), from which
issue minute spermatia, which have never been known to
germinate, and are therefore generally regarded as male
reproductive cells.

All the three kinds of spores above described, it must
now be explained, are produced in succession by some of
the Uredines on the same mycelium. The Puccinias of
the mint, primrose, violet, goat's-beard, and onion de-
velop all three forms ; teluto- uredo- and aecidiospores
occur on the same plant. Had we examined the bramble
Phragmidium earlier in the season we should have found,
not the many-celled telutospores, but unicellular uredo-
or aecidiospores. The rose rust, *Ph. subcorticum*, and
that of the barren strawberry, *Ph. fragariae*, in like

manner bear three kinds of spore on the same host. The
rusts of the knot-grass, beet, geranium, and valerian,
caused by species of Uromyces, also possess spores of
three kinds. Others, like *U. alchemillæ* and *U. rumicis*,
have teluto and uredo but no aecidiospores. Only telut-
ospores are known to be produced by the Puccinias para-
sitic on the gout-weed, speedwell, mallow, harebell, and
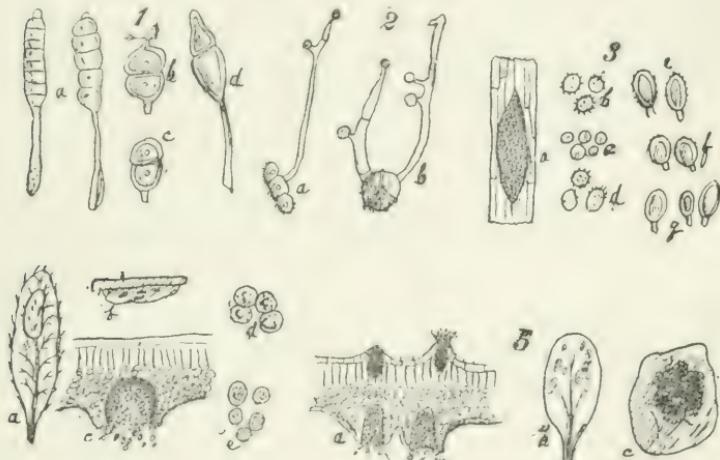
DESCRIPTION OF THE FIGURES.

1. Telutospores: a, Phragmidium violaceum; b, Puccinia menthæ; P.
violarum ; d, P. graminis. 2. Germinating telutospores with promycelia
and sporidia : a, Phragmidium ; b, Triphragmidium. 3. Uredospores : a,
grass blade with rust; b, spores of bramble rust; c, spores of barren straw-
berry; d, e, spores of corn rust; f, of rose rust; g, of thistle rust. 4. Æcidia:
a, leaf of berberry with cluster cups; b, side view of æcidia; c, leaf of sun-
spurge spotted with Melamspora; d, clustercups of bedstraw. 5. Spermo-
gonia on upper surface of leaf.

saxafrage. Uredospores are wanting in the Puccinias
of the ragwort and earth-nut; telutospores are absent in
the rusts of the figwort and fern, while neither the uredo
nor telutospores are known which correspond with the
aecidia of honeysuckle, meadow-rue, and gooseberry.
The three kinds of spore are not formed simultaneously;
further observations may therefore be expected to reduce
the number of these exceptions. Before it was known

that a cluster-cup, a rust, and a brand might be merely successive stages of the same fungus, specific names had been assigned to each of the forms, with the result that some of these parasites have three names; and this inconvenience is still unavoidable in cases where the connection between the different stages has not yet been demonstrated.

But what invests this group of fungi with peculiar interest is the fact that many of them spend their first or aecidium-bearing stage on a different species of host-plant from that which they inhabit at a later period of their life history, when they develop uredo- and telutospores. Thus there are several kinds which produce aecidia on the leaves of firs and pines, and then migrate to plants of the Heath order. To this changing of hosts the name Heterœcism (*heter*, "other"; *oikos*, "house") has been given. Analogous phenomena are observed among animal parasites. The same organism which occasions "measles" in pork, causes the tapeworm in man while in the cat it is but a more advanced form of one that inhabits the intestines of the mouse; and the liver fluke of the sheep passes one part of the cycle of its development in the body of a pond snail. Farmers long suspected that the presence of berberry bushes in their hedges had something to do with the rust that destroyed their wheat. This idea was verified by the discovery that *Puccinia graminis* is merely a later stage in the development of *Æcidium berberidis* which infests the berberry. As the alternation of generations was first traced in this species, it is the example of heterœcism usually given in text-books, but a similar connection has been made out in many other instances. The cluster-cups of the Scotch fir belong to the same Uredine which bears teluto- and uredospores on the groundsel; those of the colt's-foot correspond to telutospores on the meadow grass of *Puccinia poarum*: *Æcidium urticæ* of the nettle devel-

opes uredospores on species of Carex; the aecidium fruits
of *Gymnosporangium cancellata* occur only on the leaves of
the mountain ash and other Pomaceae, the telutospores
only upon those of species of juniper.   The aecidium of
the buckthorn is related in the same way to *Puccinia cor-
onata*, not uncommon on grasses.   Again, the aecidia of
the orchid, onion, dock; and dandelion appear in their
uredo forms on various grasses and sedges, while the
parasites of certain Composites seem to migrate to other
plants of the same order.   The corn rust, *P. rubigo vera*,
turns out to be the second stage of an aecidium that grows
on the leaves of Anchusa and other plants of the borage
family.

From these examples it will be seen that in fungi of
this description each generation of each species has its
own form of fructification and its own peculiar host-
plant.   The brands of the mint and bramble are not het-
eroecious, but produce all three sorts of spore on the same
host, or even on the same mycelium; the Uredines of the
honey-suckle, meadow-rue, and gooseberry, of which only
the aecidium forms are known, are likewise restricted to
one species of host.   In this country *Æ. grossularia* only
produces aecidiospores; telutospores are stated to have
been observed on the gooseberry itself on the Continent.
Should this be confirmed, it would appear that the fun-
gus in question is confined during its whole existence to
to the same plant, and does not, therefore, possess the
heteroecismal character.

In the life history of one of these migratory fungi we
have then the following phases:—The earliest form in-
habits the leaves of a plant such as the berberry, where
it exhausts its eneriges and completes its career by the
production and discharge of the aecidiospores ; the latter
are incapable of germinating on the berberry, but on
being transferred to wheat, at once germinate and form a
mycelium which develops the uredo and telutospores.

The uredospores continue to propagate the uredo form of the fungus indefinitely upon the wheat, but the telutospores or sporidia arising from them will only grow mycelia if sown on the leaves of the berberry.

In not a few instances these relationships have been established by direct experiment. Dr. C. B. Plowright succeeded in producing aecidia on the hawthorn and mountain ash by infecting their leaves with telutospores taken from the juniper, and on the nettle with telutospores from a species of Carex. Conversely, with aecidiospores from the nettle he obtained the uredospores of *Puccinia caricis* on Carex, and spores from the colt's-foot cluster-cup placed on the meadow grass developed the uredo form of *P. porarum*. The aecidium of the berberry gave rise to *P. graminis* on grass, and berberry leaves infected with telutospores from the latter developed aecidia of the usual form. Check plants which in these experiments were not inoculated yielded negative results; the possibility of error was thus eliminated. It may therefore be taken as conclusively proved that many of these leaf fungi exist in alternate generations as parasites on distinct plants, with forms so unlike that the successive phases in the life cycle of one and the same fungus were long regarded as different species and classified in separate families. The brilliant orange and scarlet tints exhibited by so many Uredines are due to the presence in their cells of drops of highly-coloured oil. They differ from the Peronosporeæ in their septate mycelium, and are less destructive, as the mycelium does not extend through the entire body of the host, but the damage is usually restricted to the small affected areas of the leaf. Sexual reproduction has not been observed in the Uredines; there are, however, grounds for the belief that a process of fertilization really takes place, but the consideration of this question must be reserved for another occasion.--*Knowledge*.

The Dennis Fluorometer.

WITH FRONTISPIECE.

It is the function of this instrument to establish, with precision, the location of any foreign object within the human organism which is impermeable or comparatively impermeable to the X-rays. In other words it is the province of the fluorometer to enable observers to form an exact and certain diagnosis in cases of presence of coins, bullets, needles, calculi or any other substance which is compart'vely more dense in its fluoroscopic shadow than the subject in which it is contained. It is also its function, by eliminating the distortion of position, and the distortion caused by the divergence of the rays, to provide the surgeon with absolute and reliable measurements in cases of dislocations, fractures or any abnormal conditions of the anatomy which are susceptible of reproduction in the Roentgen shadow. To obtain a correct shadow with a view to locating an object after the parallelism of the rays is accomplished, it is absolutely necessary to have a base for measurement.

To accomplish its results, it provides : A shadow of the body or limb, is thrown on the field of the fluoroscope or, on the sensitive plate, at the same time giving data which will not only enable us to make measurements but to reproduce the exact position of the body or limb. It eliminates the distortion resulting from the radiation of the force or energy known as the X ray. The distortion caused by the position of the subject or by the radiation of the energy, having been eliminated, it provides an accurate cross-section of the body or limb, and supplies an absolutely correct right-angle, at the intersection of the lines of which the foreign object will be found in the body or limb.

The fluorometer consists in a set of carefully designed metallic angle pieces, which conform generally to the shape of the body or limb, and which are susceptible of

being squared with a simple and conveniently adjustable table. When the proper position of the cross-section is obtained, the two arms of the fluorometer will present the characteristic single shadow on the field of the fluoroscope.

Attachable to the arms of the fluorometer are two pins or sights. By means of these sights, the foreign object having been brought in line with them and the proper adjustment having been made, a correct line is produced, with the sights and foreign object coincident. By means of a metallic grating, of inch mesh, which is placed adjacent to one side of the body and consequently one side of the fluorometer, exact measurments can be made with the eye from the base line, and from points on the circumference of the body, to the foreign object.

Then, without moving the body or the fluorometer, the Crookes tube is placed directly over the subject for the purpose of obtaining the vertical line. By means of an adjustable cross-piece, which is placed over the arms, exactly the same results in a vertical way are obtained by viewing the subject from beneath, the same condition of parallelism having been produced, another set of pins having been placed in position.

While the first operation locates the foreign object on an exact cross-section, the second observation shows the exact position occupied by the foreign object in that cross section. All the elements of distortion having been eliminated, the foreign body will necessarily be at the intersection of the two lines of the right angle. The first cross-section obtained is shown by a line of India ink or iodine on the body.

Very early in the history of the X-ray it was found that it was a very deceptive guide, and that, wherever a a foreign substance which was less permeable than its surroundings might be, it was certainly not in the position indicated by the so-called radiographs or skia-

graphs, and, as a consequence, two views taken at right angles, would not disclose the location of the object. It was at once apparent that the visible effect of the Roentgen ray, whether in its action on a sensitive plate or paper, or its visual effect on the fluorescent screen, is a shadow only. It must be remembered that we are dealing with a shadow, which is not only treacherous, but is lacking in the dimension of thickness. When the X ray once starts it goes straight to infinity. Thus it has happened in many cases that, while apparently a bullet or needle, for instance, was located in a certain position with reference to the anatomy, as shown by a skiagraph, it would be found that it was not at the place indicated. It is not necessary to enlarge upon this branch of the distortion, for it is familiar not only to every experimenter on the lines of the Roentgen rays, but to every surgeon who has made a skiagraph the basis of exploration.

The only practical solution of the difficulty is to establish a definite cross section of the patient by means of angle pieces, which would be less permeable than any portion of the subject, and which could be made to retain their relative position to the subject, and with the parallelism of the rays through the process of producing the angles. Having established this cross-section, it was found that it was desirable that it should be formed in close proximity to the foreign object, which had been superficially located by means of the fluoroscope. An appliance was perfected which conforms in a general way to the shape of the body, the neck, the head, the foot or the limb, and which at the same time preserves the position of the body squarely in its relation with an adjustable table. This adjustable table is extremely simple, and is so arranged that when the patient is placed in the position desired, the fluorometer will rest in a groove on the table, in one case, and an attachment of the table in the other. Then the desired position having thus been

obtained and secured, as shown in the illustration, patient and fluorometer are quickly brought into such a

position relatively to the source of energy that it shows only a thin, characteristic line on the field of the fluoroscope. Now, if a line of India ink is drawn between the

arms of the fluorometer on the subject, the exact cross-
section of the patient, as shown on the fluoroscope, will
be made manifest. If, therefore, the cross-section is es-
tablished very close to the foreign object, it will be seen
at once that the first difficulty has been surmounted; the
object has been located in close juxtaposition to a thin
cross-section of the body or limb.

   Attachable to the table is a metallic grating with
meshes of exactly one inch. This grating, when in posi-
tion, is also square with reference to the table upon
which the patient is placed, and the normal position is
close to the side of the patient, opposite to the source of
energy. The fluoroscope is placed against this grating,
and it will be seen at once that measuring from any point
desirable, on the surface of the patient to the foreign ob-
ject, is but the matter of a moment. Just here two mov-
able pins on the arms of the fluorometer appliance come
into use. These pins are placed equidistant from the
base of the fluorometer (which is, of course, squared with
the table). Then when the table, with its patient, is ad-
justed, so that the pins or "sights" coincide with the for-
eign object, it will be known that all three are in the
parallelism of the rays, and that the characteristic dis-
tortion, caused by the angle of the rays, has been elimin-
ated. Measurements, taken with the eye by means of a
metallic grating, will thus enable the surgeon to chart
unerringly the position of the object with reference to
the surface of the body which contains it.

   How far "in" from the surface of the body it may be,
however, is, at this point, a mystery. Now, without
moving the patient or disturbing the position of the
fluorometer, the second observation is taken.

   For convenience in using the fluoroscope, a section of
the top of the table is removable, and a proper fluoro-
metric appliance substituted, by means of which the sec-
ond right line of the right angle is determined. This

aperture in the table is also provided with the metallic
grating, and the fluorometer is provided with an attach-

ment which closes the side of the instrument which was
open during the first observation. Now, when the sur-
geon takes a position below the table, he obtains a view
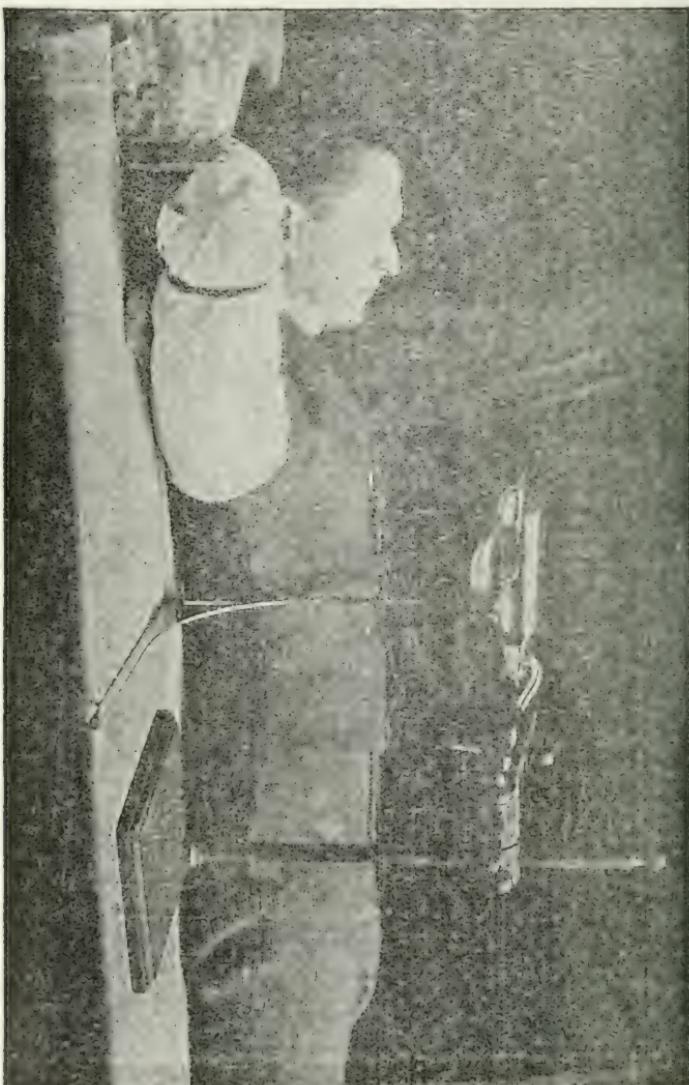
which is exactly at right angles with the first. The pins are again brought into use, and the table, patient and fluorometer, together, brought into parallelism with the rays, the tube having now been placed over the patient, as shown on the opposite page, instead of the side. The position of the foreign object again, with reference to the points on the cross-section of the subject and with reference to certain points on the fluorometer, is at once charted by the aid of the meshes of the metallic grating.

Necessarily, the foreign object must be situated at the point where the two lines coincide, the distortion caused by position, also the distortion caused by the angle of the ray having been eliminate. Where that point is, can, of course, be at once ascertained by measurment on the surface of the body.

In the case of a bullet in the brain cavity elements of uncertainty of location, having in view the desirability of a possible operation for its removal, become very grave. A very slight variation of the position occupied by the head will produce a distortion which would preclude success-full exploration. By means of the fluorometer the position of a foreign object in the brain cavity is ascertained with precision exactly as in the case of the body already given: it becomes merely a matter of cross-sections and surface measurements.

In the case of a bullet in the shoulder there is the possible difficulty of distinguishing a foreign object by examining the shadow thrown transversely to the body. With this system, however, the difficulty vanishes. Baring the shoulder, the appliance is fixed directly over the center of the foreign object, it having been disclosed by superficial view. The body is then brought into such a position that the appliance shows only the characteristic thin vertical line on the field of the fluoroscope. A line of India ink is then drawn across the shoulders to indicate the cross-section obtained. Then removing the

appliance and moving the shoulder slightly, perhaps an
inch, the instrument is placed directly over the foreign

substance and brought within the parallelism of the
rays. Again the India ink brush is brought into requi-
sition and another cross-section indicated, intersecting
the other at some point on the surface.

inch, possessed no trace of a contractile vesicle, no food-balls, a few of the linear bodies, some of the nuclear-looking bodies and nothing that could be differentiated as the original nucleus. Tne nuclear-looking bodies were granular, as the ones cited above, and instead of being free in the endoplasm, were congregated in five spherical masses, each mass being composed of from four to six units and was enclosed in a very distinct membrane, which was made even more distinct by adherent granules.

In a short while and without any apparent movement of the body, three of these spherical masses were thrown out with some force; the fissure in the ectoplasm of the encysted amœba was not closed; and the whole form collapsed, still containing two of the masses. In about fifteen minutes after being ejected, the membraneous coverings of the units were ruptured and the contained nuclear-looking bodies were freed. The average size and appearance of these bodies were the same as the ones seen discharged from the amœba first recorded. In the course of a few minutes they were seen to go through identically the same phenomena as was observed to take place with the one first mentioned. The field was now filled with these zoospores, and being free from all other forms of life, offered a good opportunity for further study.

In about three hours after beginning the observation, some of the zoospores had slackened their movements, would come to a halt for a short while, and then start off again; a number were less active than the rest and in a short while became quiescent. Selecting a quiet specimen that measured 1-2000 inch and using a ⅟ objective it could be distinctly seen to elongate itself and then resume its original size; would throw out a single minute lobate process now from one side and again from the other side. The dark blue mass of aggregated granules first observed in the nuclear-looking bodies after they had been ejected from the amœba, had become

much smaller and now represented the nucleus itself. The contractile vesicle was very distinct and the intervals between diastole and systole were short. This extrusion of lobate processes was witnessed for some time, and it was noticed that there was no change in the position of the young amœba, but that after awhile it retained the elongate form and would throw out pseudopodia from all parts of its body, that would at times, exceed the length of the zooid. At these times it had the appearance of a minute Amœba proteus, many of the forms now measured as much as 1-900 inch, without the pseudopodia. The hour being late, the slide was carefully prepared and put away with a view to continuing the observation later.

On again resuming the observation, nineteen hours afterwards, the field was found strewn with a very large number of small and active Amœba that differed from the larger forms of Amœba villosa only in the absence of the villous processes. The endoplasm was slightly granular, the nuclei and contractile vesicles as distinct as in the large forms. They were freely moving about and extruded only the lobate processes. Measurements showed them to range from 1-800 to 1-550 inch. In two places on the slide were a number of forms, from ten to fifteen, closely huddled together, as if dropped in a mass at that place. In size and shape they were the same as the free moving ones: the nuclei, contractile vesicles and anterior clear spaces being exceedingly distinct. They had a slight movement on and alongside of each other, without seeming to increase the space occupied by them. They would remind one of a litter of kittens a day or two old. In speculating on this phenomenon, one could come to the conclusion that those nuclear-looking bodies that remained in the Amœba after a part had been ejected, were developed within the confines of the body, and were freed only after the dissolution of the firm ecto-

plasm, and in this way the clusters of amœba were produced. The slide was now again laid aside, and on again resuming the observations eighteen hours after, very few forms were found, and they differed in no way from the forms seen the evening before. If food could have been supplied the observation could perhaps have been extended so as to witness the full development of these young forms.

To make this history of the sporular development of the Amœba villosa (and by inference all amœba) complete, there is only one essential requisite, and that is to trace the origin of the nuclear-looking bodies to the nucleus.

Multiple Images in Mirrors.

By WM. BALFOUR STOKES.

(Read before the Quekett Club, December 18th, 1896.)

The origin of multiple images in plate-glass mirrors, and their behaviour, seems to have attracted but little
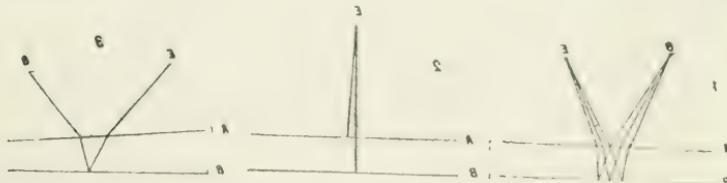
notice among microscopists. They have been noted, and a partial remedy has been prescribed, but their origin seems to have been either too simple or too complex for explanation.

When attention has been called to these images, simple, and I believe efficient, reasons have been given; but their authors did not explain the behaviour of the images when the mirror is revolved.

A figure will best show my own idea as to their origin. In Fig. 1, A is the glass surface, B the silver surface, O the object, and E the eye.

In the direction 1, 2, 3, appear the first three images. No. 1 is from the glass surface, No. 2 is from the silver surface, and No. 3 is from the silver and *air* surfaces.

Move a card along A towards 1, and No. 3 disappears first, No. 2 immediately after, and No. 1 when the card reaches that point. So much for their origin.

It will be asked, perhaps, how the images can alter their position when the mirror is revolved in the plane of A. They cannot. The mirror A B has parallel surfaces. Microscope mirrors and most plate-glass mirrors are not parallelised, but are, at the best, "optically" flattened, and may be regarded as wedges.

It is then easily seen how images approximate and retire when the mirror is revolved.

Let us give surfaces A and B an inclination of 1° (Fig. 2). Then viewing a small object at E (close to the eye) one image appears towards 1, *i.e.*, at right angles to A, and another in the direction E 2—1½° from E 1, which, after being refracted to 1° in the glass, is reflected at right angles from surface B.

There is another image nearer the letter A, but, as it follows the same laws apparently as the others, save that it is a real double reflection, we need not consider it. If this mirror is revolved in the plane of A, of course No. 1 image will remain still. No. 2 and subsequent images will revolve with the mirror round No. 1. If we exagerate this wedge shape of our mirror, we can see that at a peculiar angle these images can be made to superimpose. Let the signs be as before (Fig. 3) and the images whose rays pass respectively from O to 1 and 2^{1} will be reflected to E as one image. I should imagine the third image to arrive at E through 1, but I have not yet worked this out. Of course, placing the eye at O and the object at E would be equivalent to revolving the mirror. The images vary slightly in size owing to their various distances.

No. 2 is the brightest except at great obliquity.

EDITORIAL.

Formaldehyde.—The credit of the discovery of the powerful antiseptic properties of formaldehyde and its practical application is due to A. Frillat, who in 1888 first noticed its preserving action on samples of wine, and in 1891 made public his experiments, showing it to possess antiseptic properties much superior to all non-toxic organic antiseptics then known.

Typhoid Fever.—Water drawn from an abandoned well has given rise to several cases of typhoid fever near Rye Beach, N. Y. A party consisting of half a dozen persons went into camp near that place and drank water from it. The whole party immediately became ill, and two of the members have since died.

Fire-Blight.—This is now supposed to be due to a bacterium which enters the plant through the tender parts of the tissue, like the flower-buds or young leaf-buds as they unfold, and spreads down through the branches. When it appears on the main branches it is often called "body blight," and its presence is marked by brown and lifeless patches which become sunken. Wherever the blight appears the limbs should be cut off at once below the point where the infection has reached, and as a precaution against the spread of the disease the prunings should be burned.

MICROSCOPICAL APPARATUS.

The Micromotoscope—Is a kinetoscope for photographing cell life in motion, as seen in the microscopic field. The pictures are taken by the gelatine film at from 5,000 to 15,000 magnifications, at the rate of from 1,600 to 3,500 per minute. The images being magnified thousands of times when projected upon a screen, the views of some of the families of microbes are very realistic. It has been learned that some of them act as if intelligent. The photographs of the blood in circulation in the thinnest part of the ears and webs of the fingers, showing the cappillary

and arterial motion and the changes going on in the white cells, are of great interest. They indicate something of the nature of life and disease. The stream of circulating human blood is so swift that the eye cannot keep pace with it, and the changes in the white blood cells are correspondingly rapid. Some of the pictures show a white cell on the fast moving stream, like a white cap on the sea, constantly changing its shape. It throws out or takes in its arms like an octopus, seizing the microbes in its path. In disease this movement of the arms takes place with much less energy than in health. These pictures cannot fail to be of great value in the study of diseases. The micromotoscope will greatly aid in the investigation of phenomena of action of ameboid life in water.—*Elect. Age.*

MICROSCOPICAL MANIPULATION.

Mounting Chara.—A. Flatters finds that the fruit of chara makes a good slide when mounted in glycerin jelly. After cleaning he places it in 92 per cent alcohol for several hours, then transfers into a mixture of equal parts of spirit and glycerin for several hours longer, after which he pours off nearly all of the mixture and adds pure glycerin at intervals till the glycerin becomes concentrated. Finally the object is mounted in glycerin jelly in a cavity slip just deep enough to take it without pressure. A second method is to mount in balsam, as follows:—After cleaning, graduate through 25 per cent, 50 per cent, to 92 percent alcohol and allow to stand in the last strength for several hours. Take a tube and put in it oil of cloves. On the top of the oil pour a little absolute alcohol. Immerse the specimen gently in the alcohol and allow it to sink to the bottom of the tube. When clear mount in balsam and benzole. If transferred direct from the spirit into oil of cloves, objects will shrivel and be spoiled, hence the necessity of the graduating method. To see the antheridia properly, sections should be made.—*Science Gossip*, iv., 88.

Vegetable Sections.—The best results are obtained by first bleaching the tissues, and the best agent for this pur-

pose is Labarroque's solution (liquor sodæ chlorinata) of the U. S. P.   Put the sections in the liquor and leave until every trace of color is removed.   The time will vary according to the nature of the tissue, thickness of section, etc.   When bleached, wash the sections by allowing a gentle stream of water to flow over them until they no longer smell of the liquor, then put them in distilled water carrying one minim of nitric acid, c. p., to the ounce.   Let remain for a few moments, then transfer to absolute alcohol where they should remain one hour, before passing to the staining baths.   Except for special demonstrations where carmine, picro carmine, xanthoxylin, etc., are required, the writer prefers the aniline colors.

BACTERIOLOGY.

A Sweet Corn Bacillus.—Mr. F. C. Stewart, is studying a new bacterial disease of sweet corn.   The plants wilt and dry up, although the leaves do not roll as they do when they die from lack of moisture.   In young plants death occurs in a few days, but the disease requires from two to four weeks to run its course in older plants.   Externally affected plants appear sound, but when split the fibro-vascular bundles are found gorged with a yellow substance. When a diseased stalk is cut crosswise there exudes from the ends in yellow viscid drops a substance composed of immense numbers of short bacilli.   The disease may attack the plants at any stage of growth, but is the most virulent about the time when the ears are forming.   It does not spread from an initial centre, but is found scattered through the field.   Diseased plants frequently occur in the same hill with healthy ones.   It is found in all kinds of soil, and seems to prefer the early dwarf varieties of sweet corn.—*Garden and Forest*.

Flavoring Micrococcus of Butter.—It was a remarkable discovery, when, in April, 1896, Simeon C. Keith was studying the effects of various bacteria upon cream, and in the course of his experiments he isolated a micrococcus that was found to produce a decided butter flavor and aro-

ma when grown in milk or cream. This proved to be a new species, for which he proposed the name Micrococcus butyri-aromafaciens.

It has always been the custom to allow cream to sour or "ripen" before churning it for butter, because after this process the butter comes better and more quickly, is of better texture and flavor, and keeps better than butter made from sweet cream. Lord Lister and Pasteur, many years ago, showed that the souring of milk and cream is due to minute micro-organisms. It remained for Professor Vilhelm Storch, of Copenhagen, however, to introduce the use of pure cultures of milk-souring bacteria in butter making. Storch isolated three species that impart especially fine flavors to butter.

A similar line of work was taken up by Professor Weigmann, at Kiel, in Germany, and by Professor H. W. Conn, of Wesleyan University, in the United States.

Of the bacteria that have been described as producing a beneficial effect in the ripening of cream, Micrococcus butyri-aromafaciens most nearly resembles Conn's Bacillus No. 41 in its effects upon milk, but it differs in its morphological and in many of its physiological characters. It is a micrococcus growing at 37 degrees and 20 degrees C. It liquefies gelatin slowly, and does not grow well on potato. Recent cultures on gelatin seem to show that the organism has lost to a considerable extent its power to liquefy gelatin during a year's cultivation.

The culture of the micrococcus for use in creameries is propagated in bouillon in Fernbach flasks (broad flasks so constructed that a large surface of liquid is presented to the air). When ready for shipment, the culture is transferred to sterilized bottles under aseptic conditions and hermetically sealed by means of sterilized corks and melted paraffin. Put up in this way, the culture may be kept for an indefinite time without danger of infection by any other organism, but in the sealed bottles the micrococcus loses its vitality so rapidly that after eight days it will no longer produce the best results. Experiments made on a commercial scale show that cream ripened with the aid of

fresh, pure cultures of this organism produces generally better butter than the same cream ripened in the usual way.

The general characters are these: A micrococcus occurring generally in pairs; 0·5 to 0·7 thousandth of a millimeter in diameter, occasionally reaching 1; non-motile; no spores; grows rapidly at 37 degrees and 20 degrees C.; aerobic; slow liquefier of gelatin; non-chromogenic (white); stains well with carbol-fuchsin.—*Popular Scienc News*.

The Bacillus Icteroides—Is a small rod with rounded ends, united by pairs in cultures, from two to four micromillimeters in length, being three times as long as broad. It grows readily in all the ordinary culture media, and is easily stained by the usual solutions used for such purposes. "When the colonies are grown in the incubator they do not present marked differences from other species of microbes; they are rounded, of a slightly irridescent gray color, transparent, even in surface, and regular in outline. But if the colonies are allowed to evolve at a temperature of 20 degrees, to 22 degrees C., they look like drops of milk, opaque, projecting, and with pearly reflections." By exposing cultures for twelve hours in an incubator and then to the temperature of the air for the same length of time, they show themselves as constructed with a flat nucleus, transparent and azure, with a prominent peripheral circle that is opaque. This, the discoverer claims will distinguish the bacillus from all previously known varieties. "It is a faculative anaerobe; ferments glucose and saccharose; very resistant to drying; dies in water at 60 degrees, or after exposure to sunlight for seven hours, and lives for a long time in salt water."

Microbe of Ambergris. According to professor Beauregard, the intestinal concretions of the cachalot are caused by a microbe very similar to the comma bacillus of cholera. Here is a new field for the enterprising pharmacist; he might inoculate a few sperm whales in confinement and patiently await the formation of the calculi. The difficulty is, as usual, first to catch the cachalot.

MEDICAL MICROSCOPY.

Yellow Fever.—Walter Barker, U. S. Consul at Sagua la Grande, Cuba, reports to Surgeon General Wyman, that two of the five warehouses used for storing sugar before shipment to the United States are being used as hospitals for yellow fever and other infectious diseases among Spanish soldiers.

Typhoid Fever.—The serum test of typhoid fever has been applied to the detection of typhoid infection in water by Dr. Waytt Johnson, of Montreal, bacteriologist to the Provincial Board of Health, who has described his methods and promising results before the Montreal Medico-Chirurgical Society.

MICROSCOPICAL NOTES.

It is difficult to freeze a germ to death; but boiling quickly destroys all micro-organisms.

Make it your business to get rid of the soil where germs may grow, and the germs will seek other pastures.

Antiseptics are excellent remedies for some one else to rely upon. Better is hot water and plenty of good soap and sapolio than a solution of bichloride of mercury or carbolic acid.

Professor Virchow, has been elected a foreign associate of the Paris Academy of Sciences in the place of the late Dr. Tchebitchef.

The Prussian government will assist the fresh-water biological station at Plon after October, 1898.

Pasteur.—September, 29, 1897, was the second aniversary of Pasteur's death, and it was fittingly remembered at the Institute.

Sanitation.—A proprietor of a barber shop has very justly been fined £ 5 and costs for attending to his business while still passing through the peeling stage of scarlet fever.

At this juncture, the metallic grating is brought into use. At the point where the two lines intersect is placed a bit of metal. Then with the grating the distance down to the point occupied by the foreign substance, which is necessarily directly under, the point of intersection is measured, the line being projected parallel with the base line of the fluorometer.

The Sporular Development of the Amoeba Villosa.

BY J. C. SMITH,

NEW ORLEANS, LA.

[Read before the A. M. Society, 1897.]

In April, 1897, the writer secured some decayed leaves from a pond in the Audubon park in New Orleans, and on scraping a portion from one of the leaves, placed it under a cover-glass, and then examining it with a $\frac{1}{4}$ inch objective, the field was seen to be filled with a number of Amœba villosa, Leidy. Some of the specimens were active, some were apparently on the threshold of encystment, while others had already entered that state. The field, fortunately, was entirely free from other forms of Amœba as well as of the troublesome Paramæcium.

For awhile the field was thoroughly examined, and the writer noticing something unusual about the Amœba, concentrated his attention on one of the forms that had become quiet, and evidently about to become encysted. This specimen measured 1-125 inch, displayed the posterior well covered with the villous processes which are diagnostic of this species. The endoplasm contained a number of linear bodies and some food-balls already changed in color. The contractile vesicle was large and active, and instead of the usual nucleus, there were from ten to fifteen nuclear looking bodies that moved freely in the endoplasm in unison with a slight contraction and expansion of the body. These nuclear looking bodies were evenly dis-

persed, of a bluish tint, globular, very granular and in
size varied from 1-2750 to 1-1800 inch.   The slight con-
traction of the body became fainter, and in about one
hour there was a rapid movement of the contents of this
specimen, to the posterior extremity, and at the same
time a rupture of the seemingly dense ectoplasm of this
part. A number of the nuclear looking bodies, in com-
pany with the linear bodies and food-balls were ejected
from the body with considerable force, sending them a
distance from the body equalling one-half of its long
diameter. The Amœba now seemed to collapse and the
contractile vesicle disappeared.

My attention was now confined to the nuclear-look-
ing bodies that lay scattered about.   In the course of a
few minutes, the granules contained in these bodies be-
came partially concentrated in one place in contact with
the ectoplasm, and was of a deeper blue in color.   This
concentration of the granules left more than one-half of
each body almost clear and transparent, and in this clear
space there appeared simultaneously with the concentra-
tion, a very minute but distinct pulsating vesicle.   In a
short while a slight movement of the body was detected
and there appeared a flagellum equalling in length from
four to five of the body's diameters and was directed
stiffly forward.   The body now became very active and
in a few seconds darted off in a rapid chase about the
field, in an aimless manner, reminding the writer of the
zoospores of the *Achlya prolifera*.

Casting a glance at the other free nuclear-looking bod-
ies, it was seen that most of them were undergoing the
same change, and they were kept under observation un-
til they had all disappeared from the field, in the same
manner.   It was impossible to follow any one of these
zoospores, as the field had become filled with them.

The writer now confined his attention to one of the
encysted Amœba.   The one selected measured 1-250

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LIST OF ILLUSTRATIONS.

Publication Announcement.

The Journal will in 1898 be a 16-pp. illustrated magazine and confined very carefully to the subject of microscopy, omitting the "contributions to biology." No long articles can be accepted. Abstracts, news, and brief articles will be sought. Papers on the subject are scattered widely as is shown by our exchanges. A great number of short items and abstracts of articles will be possible. The price of subscription will be restored to one dollar.

The publication of "The Microscope" will be discontinued with this issue and its subscription list turned over to the American Monthly Microscopical Journal. That magazine will be supplied to all those who have been its subscribers. Those who have taken both periodicals will receive the Journal only unless they by post card or otherwise request a discontinuance. We shall treat all our exchanges in the same way.

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